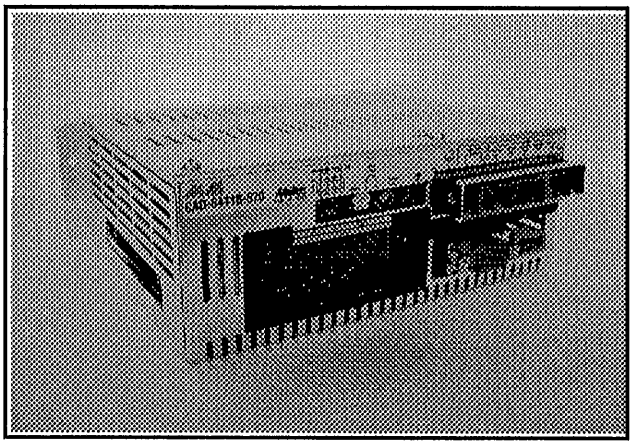
Melec



5-phase Stepping Motor Controller Driver

CAD-5411S-570

Instructions Manual

(For designers' use)

Please ensure to read and understand this Instructions Manual
before using the product.
Please keep this Instructions Manual at hand
so that it is always available for reference.

PR0769-3

PREFACE

This manual provides the information necessary to properly and securely use the CAD-5411S-570 Stepping Motor Controller Driver.
It is intended for engineers who design a controller that uses a stepping motor.
Before using the CAD-5411S-570, thoroughly read this manual to make sure you understand the specifications and the basic operation of your machine.
Please keep this manual handy.

General Safety Considerations

It is important to handle your machine in a proper way.
Misuse of the machine should cause unexpected hazards that may result in personal or property damage.
Most of these hazards can be avoided if you know possible dangerous situations beforehand.
The following safety symbols and signal words are used throughout the manual to alert you to possible hazardous situations.

⚠ WARNING	Indicates a hazard, which, if the machine is misused, can result in serious injury, including death.
⚠ CAUTION	Indicates a hazard, which, if the machine is misused, will result in minor injury,or equipment and property damage.

Before Using CAD-5411S-570

■Sine this product uses commercial power(100VAC or 115VAC), erroneous handling may cause electrification accidents.

■This product is neither designed nor manufactured for equipment that requires sophisticated reliability, including nuclear- and aerospace-related equipment, vehicles,ships, medical devices that directly involve human body,and equipment that may possibly have considerable influence upon property.

■Depending on the operational conditions, the stepping motor may step out when it is not operationg or during operation.
In particular, the load in transport may fall if the motor steps out on the vertical drive (such as the Z-axis).
Start operation after test run for deliberate confirmation of operation.

■The stepping motor may attain high temperature, depending on the operational conditions.
If the surface temperrature exceeds 100℃, provide cooling measures to control it to operate at 100℃ at the highest.

■Provide a fail-safe control so that the entire system is placed in a safe operating mode in the event of a failure
(e.g. input power failure, broken signal lines, controller failure).

■This product is provided with LIMIT (overtravel) signals to prevent mechanical damages.
This is an Active Low (input contact B) signal.
This requires a system configuration that does not use the LIMIT signal to connect this signal in the both directions to a Normally High (connected to GND) state in order to generate output pulses.

■Always use the product in a manner consistent with the instructions and within the specifications described herein.

■Check the power input for wiring before turning power on.

PREFACE
General Safety Considerations
Before Using CAD-5411S-570

CONTENTS

PAGE

1. INTRODUCTION
1-1. Features ---- 7
1-2. Controller Components ---- 7
1-3. Example of System Configuration ---- 7
1-4. External View ---- 8

2. SPECIFICATIONS
2-1. General Specifications ---- 9
2-2. Driver Specifications ---- 11
(1) Driver specifications ---- 11
(2) Applicable Motors ---- 12
2-3. Motor Control Specifications and Performance Specifications ---- 13
(1) Motor control specifications ---- 13
(2) Performance specifications ---- 16
2-4. Panel and External Control Specifications ---- 18
(1) Mode hierarchy ---- 18
(2) Panel and External Control Specifications ---- 19

3. INSTALLATION AND CONNECTION
3-1. How to Install ---- 22
(1) Installing Place ---- 22
(2) Installation Interval ---- 22
(3) How to Install ---- 23
3-2. I/O Signal ---- 24
(1) I/O signal connector ---- 24
(2) AC Input/Motor Output Terminal Block for driver ---- 25
(3) Power Connector for controller ---- 25
(4) RS232C Connector ---- 26
3-3. I/O Circuit ---- 27
(1) I/O Input Signal ---- 27
(2) I/O Output Signal ---- 27
(3) $\overline{\text{O.H.A}}$ Output Signal ---- 27
3-4. Connection Example ---- 28
(1) Example of Connection with Protection earth terminal /AC input terminal for driver ---- 28
(2) Example of Connection with Power Supply for contoroller ---- 28
(3) Example of Connection with Motor output terminal ---- 29
(4) Example of Connection with Sensor ---- 29
(5) Example of Total Connection ---- 32
3-5. Wiring Method ---- 33
(1) Wiring of I/O signal connector ---- 33
(2) Wiring of Power Connector for controlller ---- 33
(3) Wiring of Terminal block for driver ---- 34

4. Setup for Driver Section
4-1. Panel view ---- 35
4-2. Setting MOTOR SELECT switch ---- 36
4-3. Setting High-speed POWER OUTPUT SELECT switch ---- 36
4-4. Setting DRIVE CURRENT SELECT switch ---- 37
4-5. Setting STEP ANGLE SELECT switch ---- 37
4-6. Setting HOLD CURRENT ADJUSTMENT trimmer ---- 38
4-7. The check item before of a power supply input ---- 39

CONTENTS PAGE

5. DISPLAYS AND PROGRAMMING for Controller

5-1. Panel Overview ---- ４０
5-2. Panel Description ---- ４０
(1) Views in External Modes ---- ４０
(2) Views in Panel Modes ---- ４０
(3) Using panel keys ---- ４０
5-3. List of Write Data Entries ---- ４１
5-4. List of S-Curve Data Entries ---- ４５
5-5. Operations Via Panel ---- ４７
(1) Checking an External Mode is ready ---- ４７
(2) Viewing error status ---- ４７
(3) Switching Operation Modes (OP MODE) ---- ４８
(4) Switching modes ---- ４９
(5) Selecting data display digits ---- ４９
(6) Programming in Write Mode (W.M) ---- ５０
(7) Setting the current value for address in Teaching Mode via panel ---- ５１
(8) Programming in S-Curve Mode (S.M) ---- ５２
(9) Adjusting S-Curve Drive ---- ５３
(10) Using Signal Check function ---- ５５

6. SEQUENCER CONTROL

6-1. Introduction of Sequencer Control ---- ５６
6-2. List of Motion Command and Status Signal ---- ５７
(1) External Mode Select Signal and Status Signal ---- ５７
(2) Motion Command in Normal Mode and Status Signal ---- ５８
6-3. Motion Example ---- ６０
(1) Motion Flow ---- ６０
(2) Connection ---- ６０
(3) Allocated Signal Table ---- ６０
(4) Example of Ladder Circuit ---- ６１
6-4. List of Timings for External Operations ---- ６２
(1) How to issue $\overline{\text{START}}$ signal ---- ６２
(2) Timing specifications ---- ６２
(3) Delay time for $\overline{\text{START}}$ signal ---- ６２

7. RS CONTROL

7-1. Outline of RS Control ---- ６３
7-2. Communication Specifications ---- ６３
7-3. MAP-13-SWXP Specifications ---- ６３
(1) Details of screen ---- ６３
(2) Operating environment ---- ６４
(3) Operating instructions ---- ６４

8. MISCELLANEOUS SPECIFICATIONS

8-1. Automatic switching for DRIVE/HOLD ---- ６５
8-2. Motor excitation stop input($\overline{\text{M.F}}$) ---- ６５
8-3. STEP angle switcih input($\overline{\text{C.S}}$) ---- ６５
8-4. Overheat alarm($\overline{\text{O.H.A}}$) signal output ---- ６６
8-5. Special Function for driver ---- ６６
8-6. ORG DRIVE (machine home detection) ---- ６７
(1) Description of ORG DRIVE ---- ６７
(2) Types of machine home detection ---- ６８
(3) Explanation of symbols used for machine home detection process ---- ６８
(4) Process charts by machine home detection type ---- ６８
(5) ORG DRIVE DIRECTION ---- ７１
(6) HIGH SPEED ORG DRIVE (high-speed machine home detection) ---- ７１
(7) PRESET DRIVE ---- ７２
(8) PRESET DIRECTION ---- ７２
(9) MARGIN TIME ---- ７２
(10) Sensor locations ---- ７３
(11) Conditions for detecting machine home ---- ７３

CONTENTS

PAGE

8-7. SENSOR DRIVE ---------- 74
(1) SENSOR DRIVE (TYPE 0) ---------- 74
(2) SENSOR DRIVE (TYPE 1) ---------- 74
(3) SENSOR DRIVE (TYPE 4) ---------- 74
8-8. REST DRIVE ---------- 75
(1) PRESET DRIVE for INDEX and RTN DRIVE ---------- 75
(2) REST DRIVE for SENSOR DRIVE (TYPE 0) ---------- 75
(3) REST DRIVE for SENSOR DRIVE (TYPE 1) ---------- 75
(4) REST DRIVE for ORG DRIVE ---------- 75
8-9. Metric (angular) Conversion ---------- 76
8-10. Shortest-Distance Indexing ---------- 77
8-11. Teaching Specifications ---------- 78
(1) Teaching methods ---------- 78
(2) Teaching speed ---------- 78
(3) Compensation of Coordinates ---------- 78
8-12. Miscellaneous Specifications on Timing ---------- 79
8-13. External Dimensions ---------- 81

9. Characteristic table

9-1. RATE TABLE ---------- 82
(1) RATE DATA Table ---------- 82
(2) RATE Curve ---------- 82
(3) Speed Difference in RATE TYPE ---------- 83
9-2. Torque Characteristics ---------- 84

10. MAINTENANCE

10-1. Maintenance and Inspection ---------- 92
(1) Cleaning Method ---------- 92
(2) Inspection Method ---------- 92
(3) Replacing Method ---------- 93
10-2. Storage and Disposal ---------- 93
(1) Storing Method ---------- 93
(2) Disposing Method ---------- 93
10-3. Measures against Errors and Releasing Method ---------- 94
(1) Measures to be taken when an error occurred ---------- 94
(2) Notice to High Order Sequencer ---------- 95
10-4. Troubleshooting ---------- 96

For the following applied specifications and applications, a technical information is readily available.
For the technical information, please contact our Sales Department.

■When you want to change step operation of the motor at the time of a low speed, [Function to change step motion]
■When you want to change the characteristic of the motor vibration at the time of a acceleration/slowdown drive, [Function to change motor vibration]
■When selecting the External Mode for starting a motion,
・When trying a trial run for positioning at a safe speed from the sequencer, [Trace Mode]
・When setting a target address from the sequencer by teaching, [Teaching Mode]
・When writing data from the sequencer to CAD-5411S-570, [Data Programming Mode]
・When reading data of CAD-5411S-570 from the sequencer, [Data Reading Mode]
■When making communication through RS232C without using option, [RS Control]
■When checking the detail of each motion timing,
■Example
・Example of program for motion after selecting the External Mode from the sequencer
・Example of program for setting (writing) data from the sequencer,
etc.

1. INTRODUCTION

1-1.Features

Model CAD-5411S-570 rotate smoothly at the fundamental step angle by special drive of our company. Moreover, a micro step is possible a maximum of 80000 division.
You can easily position up to 50 points by setting relevant data via the front panel of the controller, selecting I/O signal-based motion commands and then starting a motor.
You can also load or save data over an RS232C interface from a personal computer and operate the controller with INDEX50 while transferring distance or HSPD (High Speed) values via sequencer I/O.

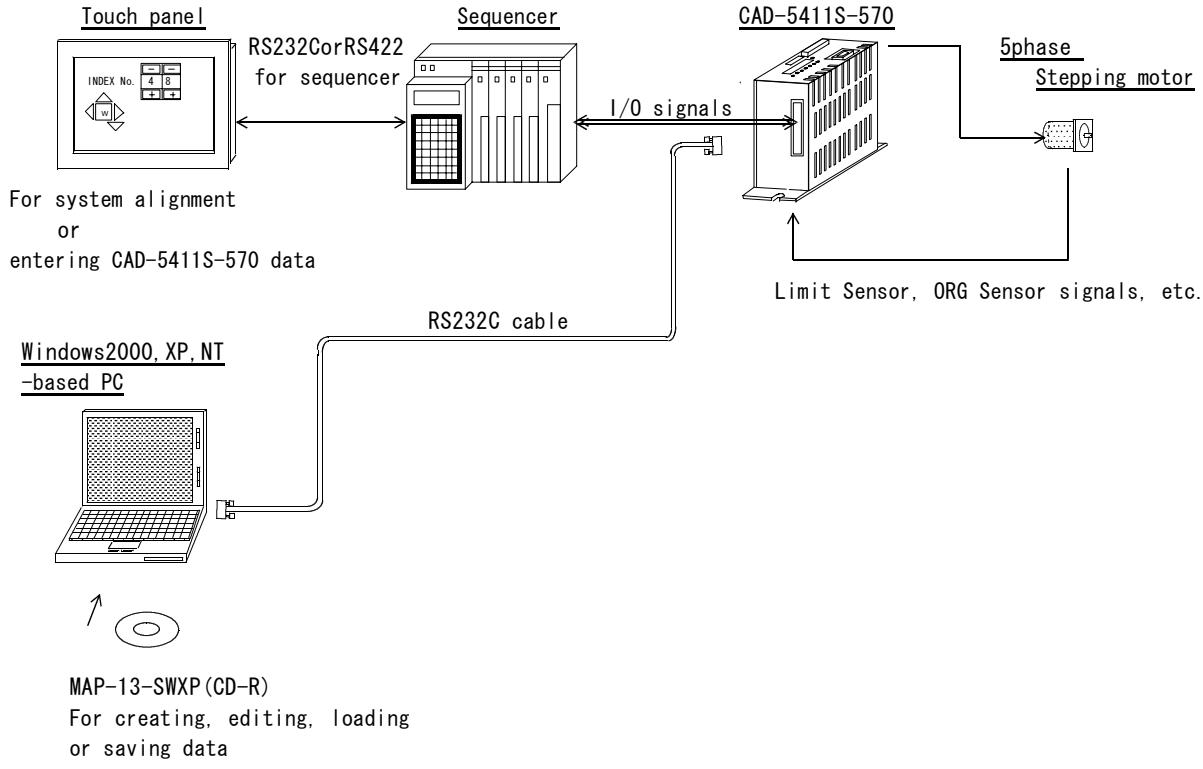
1-2.Controller Components

Component name	Model number	Manufacturer	Q'ty	Remarks
Controller driver	CAD-5411S-570	Melec	1	Main unit
I/O connectors	FCN-361J040-AU	Fujitsu	1	For connecting I/O signal connectors (provided with the CAD-5411S-570)
3-pin connectors	MSTB2.5/3-ST-5.08	PHOENIX CONTACT	1	For connecting +24V main power (provided with the CAD-5411S-570)
screws	M2.6×10	—	2	For I/O connectors (provided with the CAD-5411S-570)

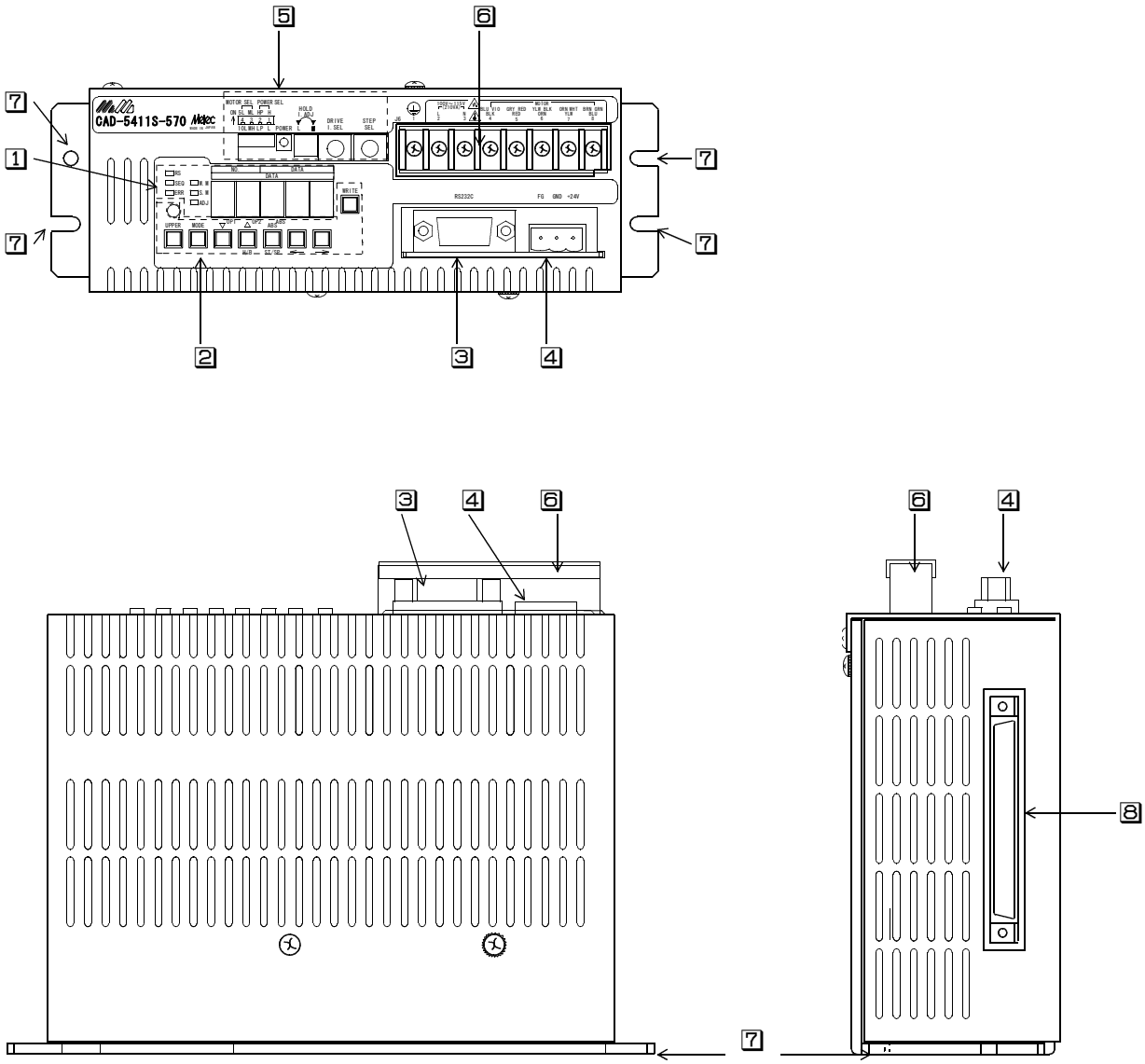
REFERENCE

Options are available for the CAD-5411S-570.
For more information on these options,please contact our dealer.

1-3.Example of System Configuration



1-4.External View



1Contains LEDs that display data or different statuses and 7-segment LEDs for controller

2Contains switches used to enter data and operate a motor in the Teaching Mode for controller

3RS232C connector

4+24V power connector for controller

5Contains POWER LED and

6AC input/Motor output terminal block for driver

7Angle for attaching the main unit

8I/O signal connector

2. SPECIFICATIONS

2-1.General Specifications

No.	Item	Specifications	Remarks
1	supply voltage	・for driver 100VAC(50/60Hz)or single-phase 115VAC(60Hz) rated power at drive:210VA(POWER SEL⇒HP・H set up) rated power at hold : 30VA(HOLD I.ADJ⇒40% set up) ・for controller DC+24V 200mA(max)	Shall be within ±10% of the supply voltage.
2	Operating temperature and humidity	0℃ ～+40℃ ・ 80%RH(max) :non-condensing	
3	Storage temperature and humidity	-10℃ ～+55℃ ・ 80%RH(max):non-condensing	
4	Withstanding Vibration	No abnomality should be found after a vibration test at 10Hz～55Hz, 0.15mmP-P.	
5	・Insulated Withstanding voltage ・Insulated Resistance	・AC 1500VAC : for one minute ・500VDC : 100MΩ or more	・AC Terminal ～+24V(I/O, RS232C Signal) ・AC Terminal ～ ⏚ Terminal
6	Installation environment	・Shall be installed in an airy chassis. Avoid areas that are subject to direct sunlight. ・Installation areas shall be free from corrosive and inflammable gas, oil mist, dust, salt, ion powders,water or chemical splash. ・Installation areas shall be free from excessive vibr ation or continuous shock. ・Do not locate the controller near significant sources of electromagnetic noise, such as power-driven equipment. ・Installation areas shall be free from radioactive material or magnetic field. Avoid locating the controller in a vacuum.	
7	I/O interfaces	+24V power interface ・Input: Photocoupler inputs	・CWLM,CCWLM,$\overline{\text{NORG}}$,$\overline{\text{ORG}}$ $\overline{\text{RESET}}$,$\overline{\text{SSO}}$,$\overline{\text{M0}}$～$\overline{\text{M8}}$ $\overline{\text{START}}$,$\overline{\text{STOP}}$,$\overline{\text{M.F}}$,$\overline{\text{C.S}}$
		・Output: Open collector transistor outputs (with photocoupler isolation) :Point-of-contact output	・$\overline{\text{ST0}}$～$\overline{\text{ST7}}$,$\overline{\text{RDY}}$,$\overline{\text{ERR}}$ ・$\overline{\text{O.H.A}}$～R.GND (Temperature sensor)
		Serial interface ・Base standard: RS232C (EIA-574 compliant) ・Communication mode: Half-duplex (full-duplex on the lines) ・Synchronization mode: Asynchronous ・Baud rates: 9.6k/19.2k/38.4k/57.6 kbps ・Data bits: 7 bits ・Parity check: Odd ・Stop bit: 1 bit ・Terminate code: CR+LF	・Directly connectable to DOS/V or IBM-compatible PC (D-SUB 9P)via an RS232C cross cable. ・Factory preset baud rate : 57.6 kbps
8	External dimensions	W161mm×D61.7mm×H125mm	

No.	Item	Specifications	Remarks
9	Connectors (on the main unit)	・Power connector :MSTBA2.5/3-G-5.08 (PHOENIX CONTACT) ・I/O signal connector:FCN-361P040-AU (Fujitsu) ・RS232C connector :D-SUB 9P ・Input/Output for driver :Terminal Block (M3, 7.62mm pich)	With a terminal block cover
10	Weight	About 1.0 kg	
11	Accessories	・Power connector :MSTB2.5/3-ST-5.08 (x 1) ・I/O signal connector :FCN-361J040-AU (x 1) ・screws :M2.6×10 (x 2)	・3-pin connector with 5.08mm pitch ・Soldering type connector with 2.54mm pitch ・For I/O connectors
12	Options	Options are available for the CAD-5411S-570.	For more information on these options, please contact our dealer.

2-2.Driver Specifications

(1)Driver Specifications

No.	Item	Specifications	Remarks
1	Motor output current	MOTOR SEL switch is set to 〔5L〕 ・DRIVE current : 0.17A/phase～0.68A/phase ・HOLD current : 0～100% of the value of the DRIVE current setting	
		MOTOR SEL switch is set to 〔10L〕 ・DRIVE current : 0.34A/phase～1.35A/phase ・HOLD current : 0～100% of the value of the DRIVE current setting	
2	Motor selection Function	Selects the applicable motor by MOTOR SELECT swicth.	
3	High-speed power output select Function	Selects high-speed torque for the motor by HIGH-SPEED POWER SELECT swicth.	
4	Hold current adjustment trimmer	Adjusts Hold current by HOLD I.ADJ trimmer.	
5	Drive current select Function	Selscts Drive current by DRIVE CURRENT SELECT switch.	
6	Step angle select Function	Selects a step angle by STEP ANGLE SELECT switch.	
7	Automatic switching for DRIVE/HOLD Function	Starting drive causes current output to the motor to change from HOLD current to DRIVE current. Moreover,after a drive stops, it changes to hold current automatically after about 150ms.	
8	Motor excitation stop input ($\overline{M.F}$)Function	Motor output current is shut off with the $\overline{M.F}$ signal on. As this time, motor torque changes to detent torque.	
9	Step angle switch input ($\overline{C.S}$)Function	Step angle division is switched to 1/20 divisions with the $\overline{C.S}$ signal on. The setting for the STEP ANGLE SELECT switch is ignored.	
10	Overheat alarm signal output ($\overline{O.H.A}$) Function	In case of internal temperrature reaches about 65℃ or higher, a signal is output(the temperature sensor contact). Continuous operation is possible unless this signal is output.	

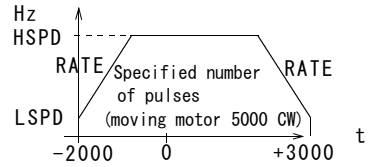
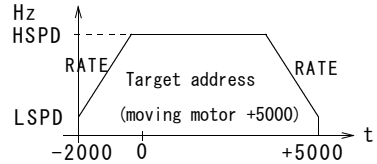
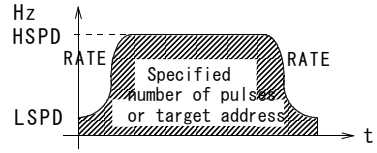
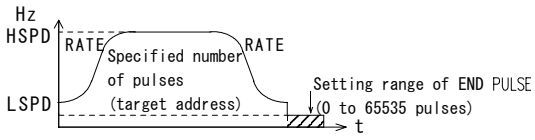
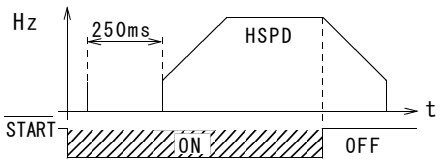
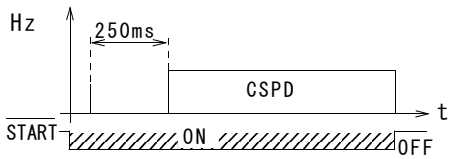
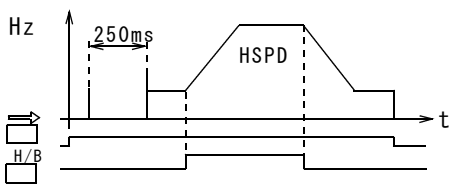
(2)Applicable Motors

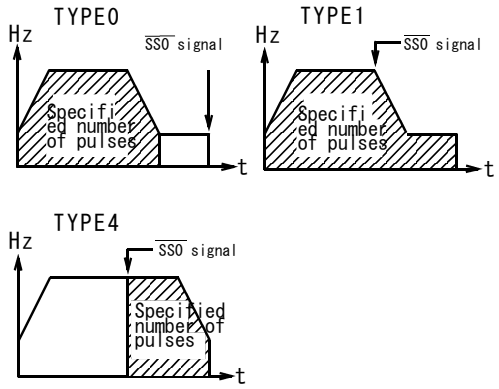
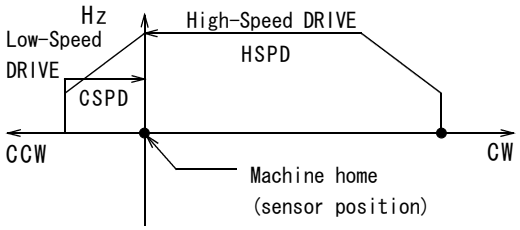
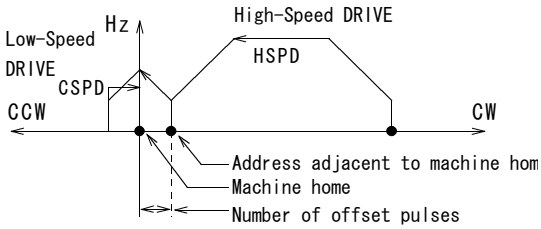
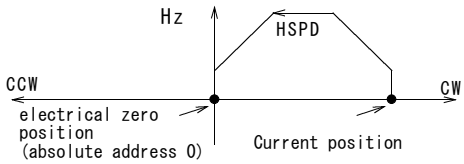
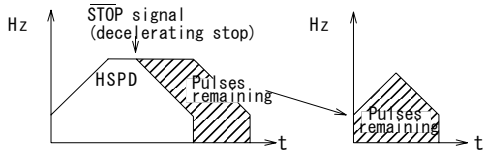
5-phase stepping motors applicable motors		Basic angle (°)	Current (A/phase)	setting DRIVE I.SEL switch No.	setting MOTOR SEL switch3	setting MOTOR SEL switch4	Torque data Fig. No.
SANYO DENKI Co., Ltd.	5M33HA(B) 5M34HA(B)	0.36	0.75	F	OFF (MH)	ON (5L)	Fig.1 2
	5M64A(B) 5M66HA(B) 5M69A(B) 5M96A(B) 5M99A(B) 5M913A(B)	0.72	0.75	F	OFF (MH)	ON (5L)	Fig.3 4 5 6 7 8
	103H7521-7051(7021) 103H7522-7051(7021) 103H7523-7051(7021) 103H8581-7041(7011) 103H8582-7041(7011)	0.72	0.75	F	OFF (MH)	ON (5L)	Fig.9 10 11 12 13
ORIENTAL MOTOR Co., Ltd.	PX533MH-A(B) PX534MH-A(B) PX535MH-A(B)	0.36	0.75	6	OFF (MH)	OFF (10L)	Fig.14 15 16
	PH544-A(B) PH554-A2(B2) PH564-A(B) PH566-A(B)	0.72	0.75	6	OFF (MH)	OFF (10L)	Fig.17 18 19 20
	PH566H-A(B)	0.72	1.3	E	OFF (MH)	OFF (10L)	Fig.21
	PH569-A(B)	0.72	1.4	F			22
	PH596-A(B)	0.72	1.25	D			23
	PH599-A(B)	0.72	1.15	C			24
	PK543-A(B) PK544-A(B) PK545-A(B) PK564-A(B) PK566-A(B)	0.72	0.75	6	OFF (MH)	OFF (10L)	Fig.25 26 27 28 29
	PK564H-A(B) PK566H-A(B) PK569-A(B) PK596-A(B) PK599-A(B)	0.72	1.4	F	OFF (MH)	OFF (10L)	Fig.30 31 32 33 34
setting upon shipping				F			—

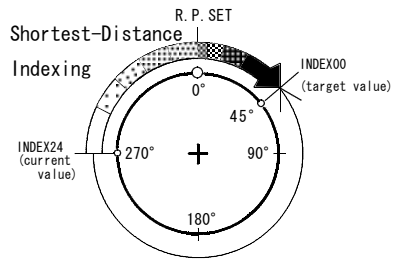
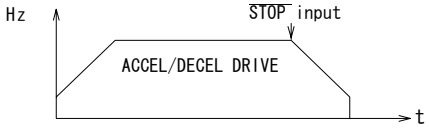
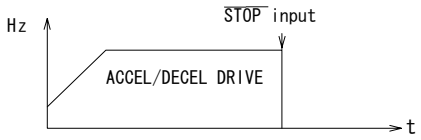
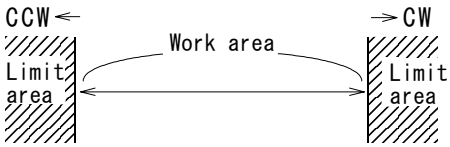
( ) : Both axes

2-3.Motor Control Specifications and Performance Specifications

(1)**Motor control specifications**

No.	Motion Controls	Description	
1	INDEX DRIVE (INCREMENTAL)		INCREMENTAL INDEX DRIVE moves the motor the specified distance (specified number of pulses) from the current position. This is a basic DRIVE for positioning.
2	INDEX DRIVE (ABSOLUTE)		ABSOLUTE INDEX DRIVE moves the motor to the specified address irrespective of the current position. This is a basic DRIVE for positioning.
3	S-CURVE INDEX DRIVE		S-CURVE INDEX DRIVE smoothly accelerates or decelerates the motor in an S-curve.
4	END PULSE DRIVE		This function alleviates damping at the end of S-CURVE INDEX DRIVE. Upon completion of deceleration down to a low speed, it continuously moves the motor in accordance with the specified frequency and specified number of pulses.
5	M.SCAN DRIVE (MANUAL SCAN DRIVE)		M.SCAN DRIVE (MANUAL SCAN DRIVE) activates single-pulse and continuous drive functions. A START signal input activates the single-pulse drive, after which an input the duration of which is more than 250 msec activates the continuous drive function that accelerates the motor up to HSPD.The number of pulses output for deceleration depends on the setting values for HSPD and LSPD rates.
6	M.CSACN DRIVE (MANUAL CONSTANT SCAN DRIVE)		M. SCAN DRIVE (MANUAL CONSTANT SCAN DRIVE) activates single-pulse and continuous drive functions. A START signal input or press of ⇦⇨ key activates the single-pulse drive, after which an input the duration of which is more than 250 msec activates a constant-speed continuous drive function. The number of pulses output for stopping the motor is within 9pulses.
7	SPECAL SCAN DRIVE		SPECIAL SCAN DRIVE activates the continuous drive function while the ⇦⇨ key on the panel is held down. Press of H/B key accelerates the motor to HSPD.

No.	Motion Controls	Description	
8	SENSOR DRIVE		SENSOR DRIVE stops or decelerates the motor with SENSOR STOP (SSO) signal input. ・TYPE0 stops the motor when $\overline{SSO}$ signal is issued upon completion of an INCREMENTAL INDEX DRIVE. The number of pulses (N) output when $\overline{SSO}$ is detected is within $N=LSPD(Hz)\times3.0\times10^{-6}+1$. ・TYPE1 decelerates the motor when $\overline{SSO}$ issued and then moves it a specified distance before stopping it. ・TYPE4 moves the motor a specified distance from the moment $\overline{SSO}$ is issued before stopping it.
9	ORG DRIVE		ORG DRIVE detects the machine home. It automatically detects the machine home when ORG motion control is initiated. Select a detection method that conforms to your intended accuracy, detection time, and specifications from nine options. Detecting the machine home with two sensors, NORG and ORG, requires a distance corresponding to $N = 0.005\times CSPD$ in terms of the number of pulses (N).
10	HIGH SPEED ORG DRIVE		HIGH SPEED ORG DRIVE reduces the time required to detect home when an ORG DRIVE is repeated. It moves the motor at a high speed set in HSPD as far as the address adjacent to the machine home specified by the number of offset pulses and then detects the machine home in the same process as for the normal ORG DRIVE.
11	RTN DRIVE and R.P SET	 ▲ R.P.SET(electrical zero) position (Set to the electrical zero when the machine home is detected.)	A DRIVE function that moves the motor back to the electrical zero (absolute address 0) irrespective of the current position. When the machine home is detected (ORG DRIVE), it is automatically set as electrical zero with R.P. SET. If the machine home differs from the electrical zero, use R.P. SET to re-specify the electrical zero position.
12	REST DRIVE		REST DRIVE executes the pulses left over when the motor is decelerated to a stop during all DRIVE functions for positioning except SCAN DRIVE and SENSOR DRIVE (TYPE 4) in execution.

No.	Motion Controls	Description	
13	Shortest-Distance Indexing		In controlling motor motions within one revolution, when one of INDEX00 through INDEX50 or RTN DRIVE is activated, the controller automatically determines the direction allowing the motor to quickly move from the current position to a target position and then moves the motor the shortest distance.
14	STOP (Decelerating Stop)		STOP (Decelerating Stop) decelerates the motor to a stop when ACCEL/DECEL DRIVE is active. The number of pulses output upon acceptance of STOP depends on HSPD and LSPD rates. When the motor is run at a fixed speed, it stops within one pulse.
15	STOP (Immediate Stop)		Stops the motor immediately when ACCEL/DECEL DRIVE is active or the motor is run at a fixed speed. The number of pulses output upon acceptance of STOP is within one pulse.
16	LIMIT STOP (CWLM, CCWLM)		CWLM signal causes the motor to immediately stop rotating CW. CCWLM signal causes the motor to immediately stop rotating CCW. The number of pulses output upon acceptance of LIMIT is within one pulse.

(2)Performance specifications

No.	Item	Description	
1	Drive function	INDEX DRIVE (Trapezoidal/S-Curve Drive)	Moves the motor a specified distance or indexes it to the target address. The S-Curve Drive is a Drive that has an S-curve acceleration/deceleration profile.
		SCAN DRIVE (including M. SCAN DRIVE)	Continuously moves the motor as long as the $\overline{\text{START}}$ signal is issued (or the relevant key on the panel is held down).
		ORG(ORIGIN) DRIVE	Automatically detects the machine home (nine detection methods are available).
		RTN(RETURN) DRIVE	Moves the motor back to the electrical zero. (R.P. SET position)
		SENSOR DRIVE	Decelerates or stops the motor with SENSOR signal. (threedetection methods are available)
		REST DRIVE	Indexes the motor the pulses left over when Decelerating Stop is activated with $\overline{\text{STOP}}$ signal.
		END PULSE DRIVE	Suppresses motor damping when the pulse output stops with S-Curve Drive activated.
		Shortest-Distance Indexing	Automatically selects the direction of revolution allowing the axis to reach the point for positioning through the shortest path in controlling the rotation system.
2	Number of pulses output	M.SCAN DRIVE、M.CSCAN DRIVE SPECIAL SCAN DRIVE	0 ～ ∞ (infinite) PULSES/DRIVE
		INCREMENTAL INDEX DRIVE	0 ～ 8,388,607 PULSES/DRIVE
		ABSOLUTE INDEX DRIVE	0 ～16,777,214 PULSES/DRIVE(setting range±8,388,607)
		ORG DRIVE	0 ～ ∞ (infinite) PULSES/DRIVE
		RTN DRIVE	0 ～ 8,388,607 PULSES/DRIVE
		REST DRIVE	0 ～16,777,214 PULSES/DRIVE(setting range±8,388,607)
		SENSOR DRIVE(TYPE0)	1 ～16,777,214 PULSES/DRIVE(setting range±8,388,607)
		SENSOR DRIVE(TYPE1)	1 ～ 8,388,607 PULSES/DRIVE
		SENSOR DRIVE(TYPE4)	0 ～ ∞ (infinite) PULSES/DRIVE(SCAN DRIVE) 1 ～ 8,388,607 PULSES/DRIVE(INDEX DRIVE)
3	Speed and rate characteristics		

Item	L-TYPE	M1-TYPE (RESOLUTION10)	M2-TYPE (RESOLUTION20)	H-TYPE
Speed setting range(LSPD)	10Hz～100kHz	10Hz～ 800kHz *2	10Hz～ 800kHz *2	10Hz～ 1.6MHz *2
Speed setting range (other than those above)	1Hz～100kHz	1Hz～ 800kHz *2	1Hz～ 800kHz *2	1Hz～ 1.6MHz *2
Rate setting range	1000ms/1kHz ～1.0ms/1kHz (22 steps)	100ms/1kHz ～0.1ms/1kHz (15 steps)	50ms/1kHz ～0.05ms/1kHz (15 steps)	5.0ms/1kHz ～0.005ms/1kHz (15 steps)
Difference in speeds *1	51Hz/STEP ～62Hz/STEP	500Hz/STEP ～2kHz/STEP	1kHz/STEP ～4kHz/STEP	10kHz/STEP ～68kHz/STEP

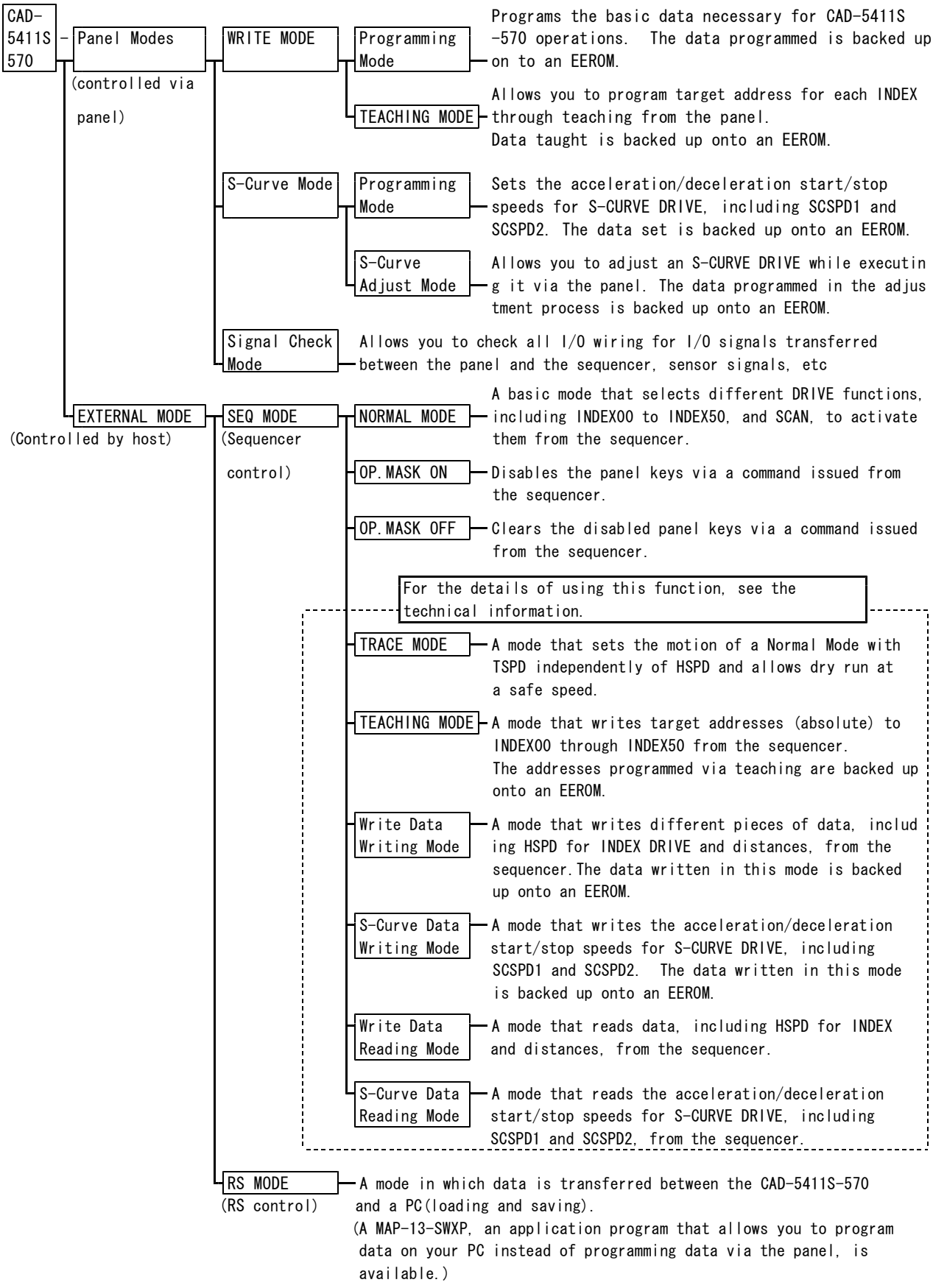
*1 Difference in speeds is the speed variations between the moment the motor is run at a given speed and the moment it is accelerated or decelerated. This difference is relatively small when the motor is run at a low speed, whereas it gradually increases as it is accelerated to a higher speed.
M1-TYPE (RESOLUTION 10) decreases the difference and suppresses the influence of noise or vibration generated from the motor compared with M2-TYPE(RESOLUTION 20). On the contrary, for the rate setting, M1-TYPE (RESOLUTION 10) is slower than M2-TYPE (RESOLUTION 20).

*2 The setting value of a controller is expressed. The highest response frequency of a driver is to 500kHz(max).

No.	Item	Description	
4	DRIVE startup time	Less than 1.1 ms (in Trapezoidal)	The period of time between the moment $\overline{\text{START}}$ signal is sent from a host and the moment the controller starts outputting pulses.
		・When Write Data No. A8 (DELAY TIME) is set to 0.1ms (factory setting: 3 ms) ・Not applicable to S-CURVE INDEX DRIVE and SCAN DRIVE.	
5	Programmable positions	・ 51 positions, INDEX00 to INDEX50 ・ INDEX50 supports data transfer.	INDEX00 through INDEX49 allow positioning with fixed data for the preset incremental/absolute distances. INDEX50 is capable of running the motor while converting the preset initial data to positioning data or HSPD data transferred from sequencer I/O.
6	Number of data rewrites	100,000 times	Number of EEROM rewrites (valid for up to ten years when rewritten 27 times per day)

2-4.Panel and External Control Specifications

(1)Mode hierarchy


CAD-5411S-570
Panel Modes
(controlled via panel)
WRITE MODE
Programming Mode
Programs the basic data necessary for CAD-5411S-570 operations. The data programmed is backed up on to an EEROM.
TEACHING MODE
Allows you to program target address for each INDEX through teaching from the panel.
Data taught is backed up onto an EEROM.
S-Curve Mode
Programming Mode
Sets the acceleration/deceleration start/stop speeds for S-CURVE DRIVE, including SCSPD1 and SCSPD2. The data set is backed up onto an EEROM.
S-Curve Adjust Mode
Allows you to adjust an S-CURVE DRIVE while executing it via the panel. The data programmed in the adjustment process is backed up onto an EEROM.
Signal Check Mode
Allows you to check all I/O wiring for I/O signals transferred between the panel and the sequencer, sensor signals, etc
EXTERNAL MODE
(Controlled by host)
SEQ MODE
(Sequencer control)
NORMAL MODE
A basic mode that selects different DRIVE functions, including INDEX00 to INDEX50, and SCAN, to activate them from the sequencer.
OP.MASK ON
Disables the panel keys via a command issued from the sequencer.
OP.MASK OFF
Clears the disabled panel keys via a command issued from the sequencer.
For the details of using this function, see the technical information.
TRACE MODE
A mode that sets the motion of a Normal Mode with TSPD independently of HSPD and allows dry run at a safe speed.
TEACHING MODE
A mode that writes target addresses (absolute) to INDEX00 through INDEX50 from the sequencer.
The addresses programmed via teaching are backed up onto an EEROM.
Write Data Writing Mode
A mode that writes different pieces of data, including HSPD for INDEX DRIVE and distances, from the sequencer.The data written in this mode is backed up onto an EEROM.
S-Curve Data Writing Mode
A mode that writes the acceleration/deceleration start/stop speeds for S-CURVE DRIVE, including SCSPD1 and SCSPD2. The data written in this mode is backed up onto an EEROM.
Write Data Reading Mode
A mode that reads data, including HSPD for INDEX and distances, from the sequencer.
S-Curve Data Reading Mode
A mode that reads the acceleration/deceleration start/stop speeds for S-CURVE DRIVE, including SCSPD1 and SCSPD2, from the sequencer.
RS MODE
(RS control)
A mode in which data is transferred between the CAD-5411S-570 and a PC(loading and saving).
(A MAP-13-SWXP, an application program that allows you to program data on your PC instead of programming data via the panel, is available.)

(2)Panel and External Control Specifications

No.	Item	Description		
1	Panel Modes	W.M (Write Mode)	Programming	A mode that allows you to program data required for the CAD-5411S-570 via the panel. It sets basic parameters for controlling the motor.
			TEACHING	A mode that stores the address of the current value when running the motor with a SCAN or any other functions via the CAD-5411S-570 panel.
		S.M (S-Curve Mode)	Programming	A mode that allows you to program data required for S-CURVE INDEX DRIVE. It sets S-curve parameters required for S-CURVE DRIVE.
			S-Curve Adjust	A mode that adjusts S-curve parameters when running motor with S-CURVE INDEX DRIVE via the panel.
		・The data you can reference or enter in a Panel Mode, varies depending on the operation mode options and index types (Trapezoidal or S-curve).		
2	Operation mode options	・OP0(for operator)		Limits the data entry (change) from the CAD-5411S-570 panel to distances.
		・OP1(for designer)		Allows data entry (change) for all parameters via the CAD-5411S-570 panel and operations in the Teaching Mode as well as in S-Curve Adjust Mode.
		・OP2(for data monitor)		A mode that only allows the operator to reference all pieces of write data and S-curve data . (WRITE key is not accepted)
3	EXTERNAL MODE (EXT MODE)	Sequencer Control (SEQ Modes)	NORMAL MODE	A basic mode that externally issues normal motion commands. It allows positioning with taught positions compensated for relative to a mechanical eigenvalue.
			TRACE MODE	A mode that externally moves the motor, determining positioning data. It allows you to determine positions to teach while running the motor at a safe speed for teaching. Any DRIVE used at the speed for teaching begins with a T (teaching) such as T. INDEX.
			TEACHING MODE	A mode that externally stores the address of the current value. It allows a move to the position to teach and programming the current value. Any DRIVE used at the speed for teaching begins with a T (teaching) such as T. SCAN.
			Write Data Writing Mode	A mode that programs write data from the touch panel on a sequencer I/O level (the data programmed in this mode is backed up onto an EEROM).
			S-Curve Data Writing Mode	A mode that programs S-curve data from the touch panel on a sequencer I/O level (the data programmed in this mode is backed up onto an EEROM).
			Write Data Reading Mode	A mode that reads write data from the touch panel on a sequencer I/O level.
			S-Curve Data Reading Mode	A mode that reads S-curve data from the touch panel on a sequencer I/O level.
			OP.MASK ON	A command that externally disables operations via the CAD-5411S-570 panel. Once set, it disables the CAD-5411S-570 panelkeys until it accepts OP. MASK OFF command, power is turned off, or $\overline{\text{RESET}}$ is issued.
			OP.MASK OFF	A command that clears disabled operations via the CAD-5411S-570 panel to enable them when they were externally disabled with OP. MASK ON.
		RS Control (RS Modes)	DATA LOAD	Allows loading data for the CAD-5411S-570 via an RS232C from a PC.
			DATA SAVE	Allows saving data stored in the CAD-5411S-570 via an RS232C to a PC.

No.	Item	Description	
	EXTERNAL MODE (EXT MODE)	・When selecting an external mode you can execute on the controller, take into consideration security aspects (e.g. limiting the use to certain operators according to the system specifications). ・Switching between an RS Mode and a SEQ Mode occurs at a time for all axes connected to the CAD-5411S-570. The switching of other modes, including External Normal, Trace or Teaching, also occurs in the same manner. ・On power up or $\overline{\text{RESET}}$ input, the Normal Mode is selected from the SEQ Control Modes, notifying the operator of the initial status. ・A status signal activated by the switching of External Modes responds to programmed. When it is required to select an External Mode, it should be establis and the External Mode statues output held in ladder logic. It is possible to drive the motor, keeping track of all operating statues of the CAD-5411S-570 by assuming the conditions with External Mode statues held in the ladder logic and the CAD-5411S-570 output statuses. ・For External Normal, Trace and Teaching Modes, it is possible to read the address of the current value from the I/O while the motor is idle.	
4	Machine home detection	ORG0,ORG1,ORG2,ORG3,ORG4 ORG5,ORG10,ORG11,ORG12	Select an ORG detection method that is best suited for your system in terms of the number of sensors, detection time, and accuracy, from nine options.
		HIGH SPEED ORG	A function that reduces the time required for detecting the home after a Reset from the second time onwards.
		ORG DIRECTION	Select a direction to detect the home depending on the motor revolution direction or the home position (left or right).
		PRESET DRIVE and PRESET PULSE	An electrical zero can be programmed separately from the mechanical home to avoid mechanical hunting. Programming preset pulses to avoid the extent to which a mechanical hunting occurs when the $\overline{\text{ORG}}$ sensor is detected ensures stable detection of machine home.
		OFFSET	Program an address adjacent to the machine home from which the motor initially moves at a high speed with HIGH SPEED ORG as the ORG position.
		MARGIN TIME	Allows elimination of the possibility of mechanical hunting by setting a delay in the ORG detection process.
5	Establishment of electrical zero	R.P.(RETURN POSITION)SET	Allows you to establish an electrical zero if the one that differs from the machine home is required.
6	STOP function	$\overline{\text{RESET}}$ signal (Contact A Input)	Initialization from I/O line (Stop)
		CWLM,CCWLM(Contact B Input)	Emergency stop caused by detection of mechanical overtravel.
		Stop caused by $\overline{\text{SSO}}$ signal input	Shutdown caused SENSOR signal input
		$\overline{\text{STOP}}$: Either Decelerating Stop or Immediate Stop is selected	Shutdown from I/O line
		・Take into consideration the specifications for stop customized to your system. ・Take appropriate safety measures (e.g. shutting down the drive system) to shutdown the motor to avoid hazards.	

No.	Item	Description	
7	Signal Check function	Provided	I/O wiring can be checked. ・Displays states of I/O signals on the panel. ・Output signals are operated on the panel.
8	Unit Conversion	Pulse-to-mm conversion	Converts a distance per pulse to a range from 0.01μm to 999.99μm to program a distance in millimeters for running the motor.
		Pulse-to-angle conversion	Converts an angle per pulse to a range from 0.00001° to 0.99999° to program an angle in degrees for running the motor.
9	Switching of current view	Real-time view	Provides view of address of current position on the panel in real time.
		Display of distance setting	Displays specified distance or value of target address on the panel.
10	Data backup	Provided	Data is backed up onto an EEROM after power is removed.
11	DRIVE function using data transfer	Data transfer with INDEX50	INDEX50 is capable of running the motor while converting the preset initial data to positioning data or HSPD data transferred from sequencer I/O. The preset data for INDEX50 is backed up on a memory, whereas the distance and HSPD values transferred from sequencer I/O in a Normal Mode is retained until power is turned off or a $\overline{\text{RESET}}$ input is issued. When data change is not involved, data needs not be transferred with INDEX50.
12	Setting of I/O data	・Writing/Reading of Write Data ・Writing/Reading of S-Curve Data	Allows the setting of parameters for the CAD-5411S-570 from sequencer I/O Allows the reading of CAD-5411S-570 internal data from sequencer.
13	Batch HSPD Write	Provided	Allows the user to enter the same value for HSPD applied to INDEX00-INDEX50 motions in one step.
14	Teaching	・Setting the controller in Teaching Mode via I/O ・Setting the controller in Teaching Mode from panel	Allows the setting of address of current value from sequencer (I/O) or via panel with INDEX00-INDES50 being specified.
15	Teaching Offset	Provided	When the position taught via a CCD camera or the like differs from the workpiece position requiring practical positioning, this function runs the motor by applying a relative offset obtained from the conversion of a distance to pulses.

3. INSTALLATION AND CONNECTION

⚠ WARNING

Overheating may cause fire.
Mount it on noncombustible member.
Keep it away from combustibles.

3-1.How to Install

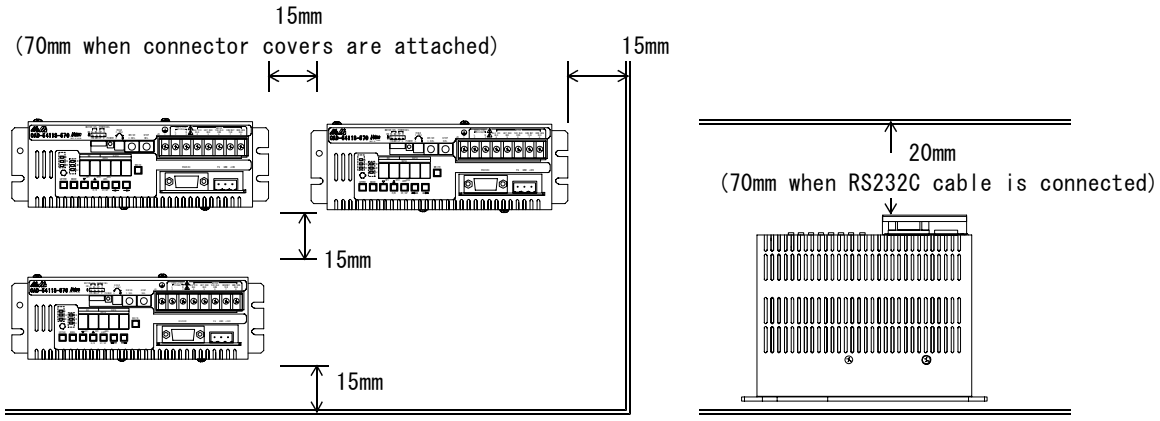
(1)Installing Place

CAD-5411S-570 are designed and manufactured for assembling equipment.
Install them at the following places:

- In an airy chassis installed indoors (Avoid places that are exposed to direct sunlight.)
- Working ambient temperature and humidity: 0℃～+40℃ 80%RH max. (non-condensing)
- A place free from corrosive gas and inflammable gas
- A place free from dirt, dust, salt and iron powder.
- A place not exposed to splashes of water, oil or chemical.
- A place free from continuous vibrations or excessive shock.
- A place where is hardly influenced by electromagnetic noises caused by any power-driven equipment.
- A place free from radioactive material, magnetic field and vacuum.

(2)Installation Interval

Install the CAD-5411S-570 more than 15mm away from the chassis or other equipment in the chassis in order to air flow.
When attaching commercial covers (produced by Fujitsu) to I/O connectors,inserting RS232C cable after installation make the interval 70mm.



■Considering heat release, control the ambient temperature around the driver within the specified value.

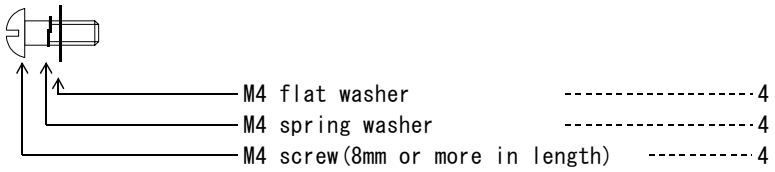
- Take measures against accumulation of heat such as allowing generous space around the CAD-5411S-570 or installing a fan so that heat release is taken care of by convertion.
- Install the CAD-5411S-570 securely in contact with metal or other substance with adequate heat conductivity.

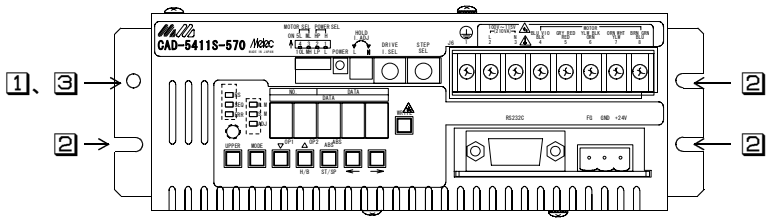
■Do not allow standing or placing anything heavy on the product.

(3)How to Install

Install the CAD-5411S-570 in the horizontal direction by facing the product panel to the upper face or in the vertical direction by facing the panel to the front.

The following items are required.





1 Temporarily fix the product at the round hole.

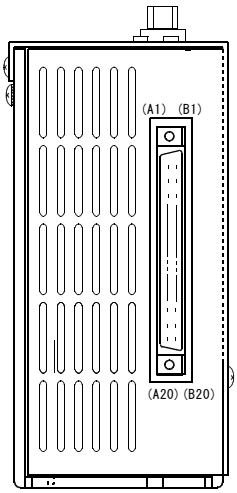
2 Fix the product at the three cutouts.

3 Fasten the screw in the round hole.

3-2.I/O Signal

(1)I/O signal connector

■Connector drawing



・Connector·····FCN-361P040-AU (of Fujitsu: Body side)

・Applicable connector···· FCN-361J040-AU (of Fujitsu: Accessory 2.54mm pitch, Soldering type)

・Applicable wire ·····AWG28 (About 0.075mm²)～ AWG22 (About 0.3mm²)

■Signal Table

I/O signal connector							
No.	Signal name	Dir.	Description	No.	Signal name	Dir.	Description
A1	CWLM *1	IN	+(CW)direction LIMIT signal	B1	GND *2	—	Return GND
A2	CCWLM *1	IN	-(CCW)direction LIMIT signal	B2	NC	—	Use is prohibited.
A3	$\overline{\text{NORG}}$	IN	Signal adjacent to machine home	B3	NC	—	Use is prohibited.
A4	$\overline{\text{ORG}}$	IN	machine home signal	B4	NC	—	Use is prohibited.
A5	$\overline{\text{SSO}}$	IN	Sensor signal for SENSOR DRIVE	B5	NC	—	Use is prohibited.
A6	NC	—	Use is prohibited.	B6	NC	—	Use is prohibited.
A7	$\overline{\text{M.F}}$	IN	Motor excitation stop signal	B7	$\overline{\text{O.H.A}}$	OUT	Overheat alarm signal
A8	$\overline{\text{C.S}}$	IN	Step angle switch signal	B8	R.GND *3	—	Return GND for $\overline{\text{O.H.A}}$
A9	$\overline{\text{RESET}}$	IN	Signal to initialize the body	B9	NC	—	Use is prohibited.
A10	$\overline{\text{M0}}$	IN	Signal to designate operation mode and each operation and to set data. (For the detail,see Chapter 6-2.)	B10	$\overline{\text{ST0}}$	OUT	Signal to inform operation mode, each operation status and data. (For the detail, see Chapter 6-2.)
A11	$\overline{\text{M1}}$	IN		B11	$\overline{\text{ST1}}$	OUT	
A12	$\overline{\text{M2}}$	IN		B12	$\overline{\text{ST2}}$	OUT	
A13	$\overline{\text{M3}}$	IN		B13	$\overline{\text{ST3}}$	OUT	
A14	$\overline{\text{M4}}$	IN		B14	$\overline{\text{ST4}}$	OUT	
A15	$\overline{\text{M5}}$	IN		B15	$\overline{\text{ST5}}$	OUT	
A16	$\overline{\text{M6}}$	IN		B16	$\overline{\text{ST6}}$ *4	OUT	
A17	$\overline{\text{M7}}$ *4	IN		B17	$\overline{\text{ST7}}$ *4	OUT	
A18	$\overline{\text{M8}}$ *4	IN		B18	N.C	—	Use is prohibited.
A19	$\overline{\text{STOP}}$	IN	Signal to stop operation	B19	$\overline{\text{ERR}}$	OUT	Output signal at the time of abnormaloperation
A20	$\overline{\text{START}}$	IN	Signal to start	B20	$\overline{\text{RDY}}$	OUT	Command wait signal from high order

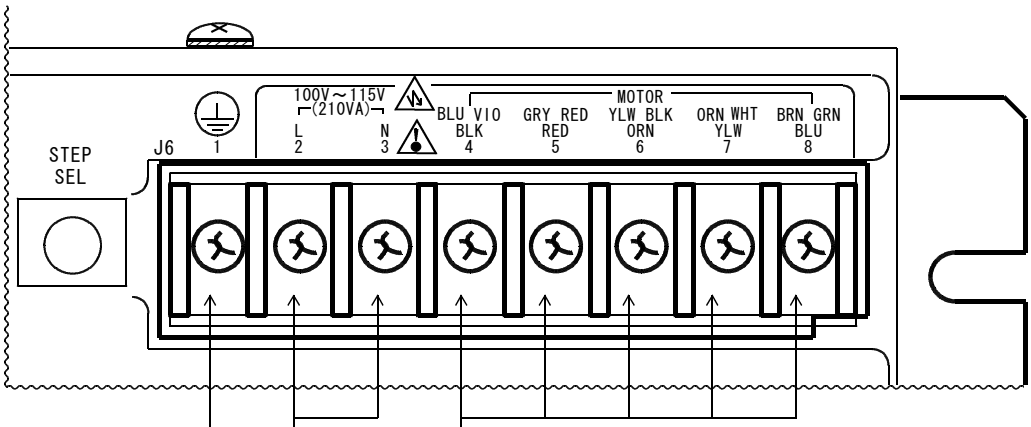
*1 When the signal is not used, connect the connector to GND.
B contact input (active high) prevents outputting pulse in case of no-connection (no-processing).

*2 Use this connector as the return GND of signal cable. +24V power connector GND and the return GND of I/O signal connector are connected inside CAD-5411S-570.
Keep it in mind that this is not F.G (frame GND) connecting shielding portions of shielded cables.

*3 It is the exclusive return GND of $\overline{\text{O.H.A}}$ signals. It has dissociated with the return GND of No.B1.

*4 Wiring may be omitted depending on operation.
・Wiring to $\overline{\text{XM8}}$ is not necessary when it is operated only in the basic Normal Mode.
・Wiring to $\overline{\text{XM8}}$,$\overline{\text{XM7}}$ and $\overline{\text{XST7}}$,$\overline{\text{XST6}}$ is not necessary when this function is not used for full.
(When data setup from I/O and the present value address read-out are not performed.)

(2)AC Input/ Motor Output Terminal Block for driver



Motor output terminal
Outputs current to drive the motor.

AC input terminal
Power input terminal.
Commercial power supply is connected.

Protection earth terminal
Protects against electrical shocks as connected to the protection earth terminal of the equipment.

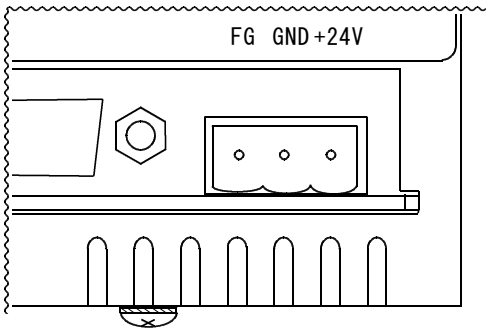
(3)Power Connector for controller

⚠ Caution

CAD-5411S-570 may be damaged.
Pay attention to power supply connecting position and polarity when wiring.

■Connector Drawing

- Connector ····· MSTBA2.5/3-G-5.08 (Phoenix Contact Corp.: Body side)
- Applicable connector ····· MSTB2.5/3-ST-5.08 (Phoenix Contact Corp.: Accessory)
- Applicable wire ····· AWG20 (About 0.5mm²)～ AWG12 (About 3.3mm²)
  In case of 2-wire connection (daisy chain), 2 wires up to AWG15 (about 1.5mm²)



(CAD-5411S-570)

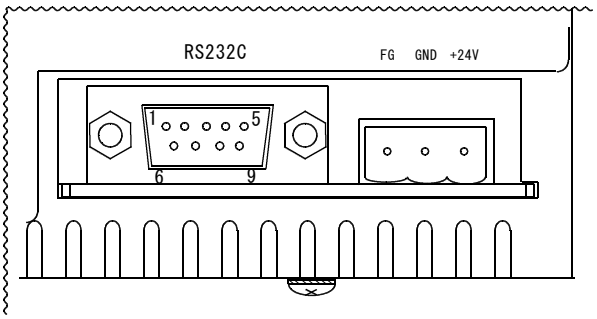
■Signal Table

Signal name	Description
F.G	Frame GND connection terminal
GND	+24V - side power input terminal
+24V	+24V + side power input terminal

(4)RS232C Connector

■Connector Drawing

・Connector ····· DELC-J9PAF-23L9 (JAE:D-SUB9P)
・Applicable cable ····· RS232C cable (D-SUB9P cross cable)



(Mating Face)

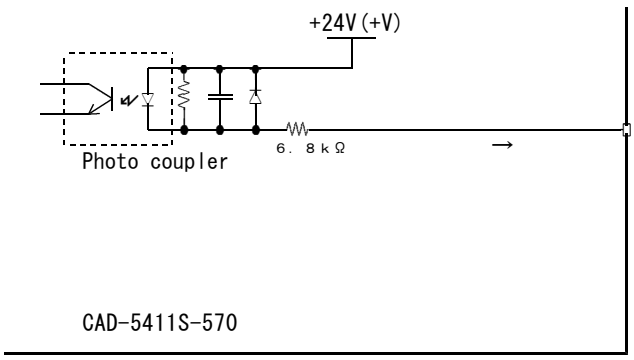
・A dust cap is attached to the RS232C connector. Remove the dust cap when using the connector. When the RS232C connector is not used, attach the dust cap to the connector in general to protect it from dusts.

■Signal Table

No.	Signal name	Dir.	Description
1	N.C	—	Not used.
2	RxD	IN	RS232C receive data signal
3	TxD	OUT	RS232C send data signal
4	N.C	—	Not used.
5	GND	—	Ground
6	N.C	—	Not used.
7	N.C	—	Not used.
8	N.C	—	Not used.
9	N.C	—	Not used.

3-3.I/O Circuit

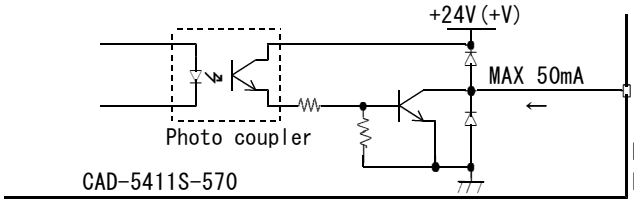
(1)I/O Input Signal



CWLM,CCWLM(B contact input)
RESET,M0～M8,START,STOP
NORG,ORG,SS0,M.F,C.S

High level 0.8mA max. [18V min. High
Low level 2.5mA min. [6V max. Low

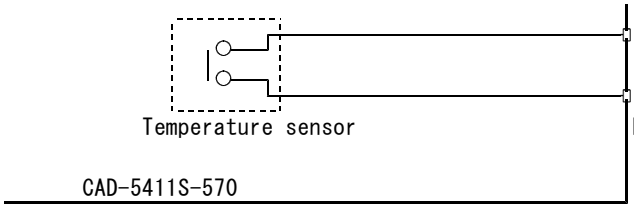
(2)I/O Output Signal



ST0～ST7,RDY,ERR

High level High impedance [Leakage current 100μA max.
Low level 2V max. [Sink current 50mA
Low level 0.6V max. [Sink current 30mA

(3)O.H.A Output Signal



O.H.A

R.GND

Point-of-contact capacity
Opening-and-closing voltage≦30V
Opening-and-closing current≦100mA
1mW≦Opening-and-closing
Electric power≦3W

3-4.Connection Example

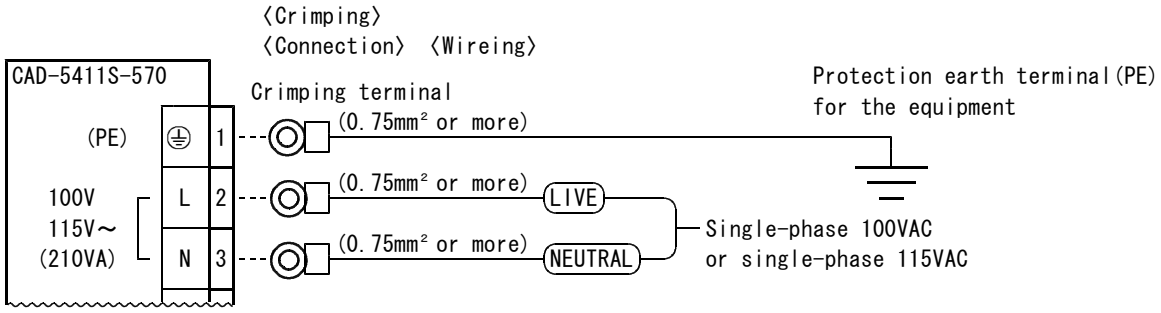
⚠ Caution

CAD-5411S-570 may be damaged.
Pay attention to power supply connecting position and polarity when wiring.

⚠ Caution

Breakage of the machine or injury is apprehended due to unexpected behavior of the motor.
Maintain the state where emergency stop is enabled at any time.

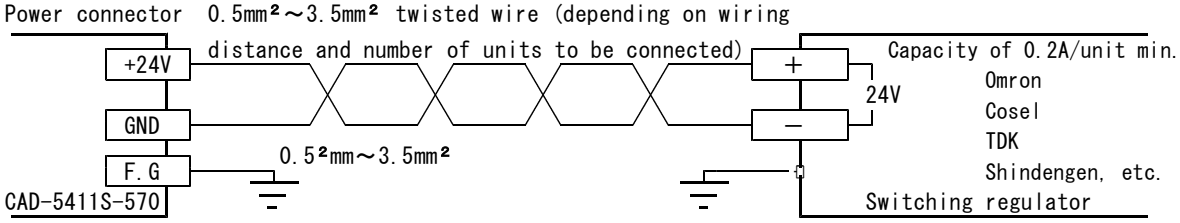
(1)Example of Connection with Protection earth terminal / AC input terminal for driver



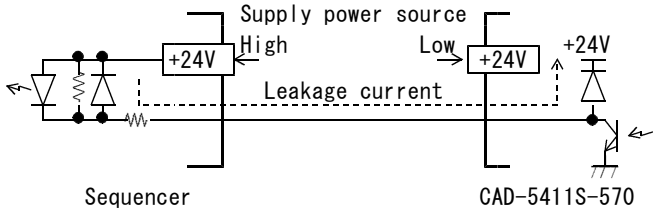
・Be sure to ground the protection earth terminal(⏚) to the protection earth terminal(PE) of the equipment, using wire rod with a section area of 0.75mm² or more.

(2)Example of Connection with Power Supply for controller

To prevent malfunction due to noise, separate the power supply from main circuit and power lines of other equipment and wire the power supply away more than 50mm from them.

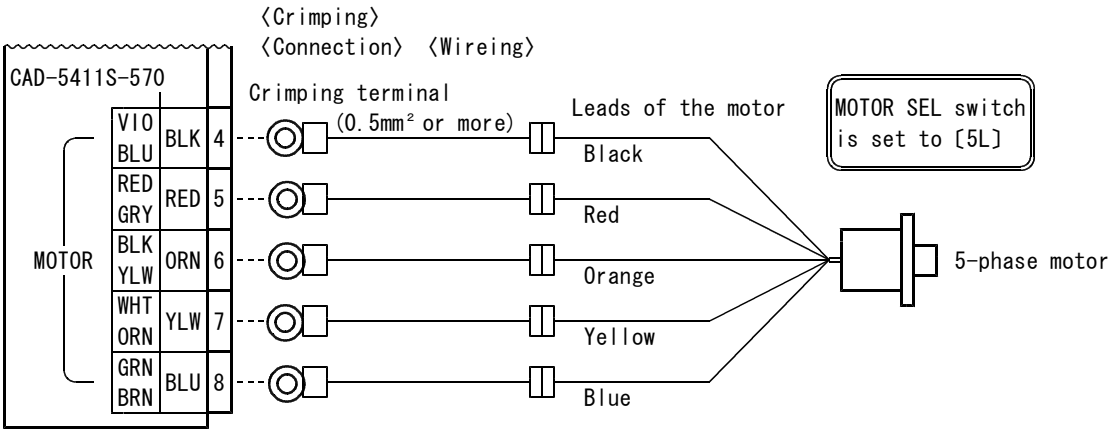


・Supply power from a common power source so that the sequence supply power source becomes equal to the CAD-5411S-570 supply power source, or try to switch CAD-5411S-570 on/off first from other equipment.
When the supply voltage to the sequencer becomes higher than the one of the supply power source of CAD-5411S-570, leakage current through the output circuit protection diode may turn on input to the sequencer.



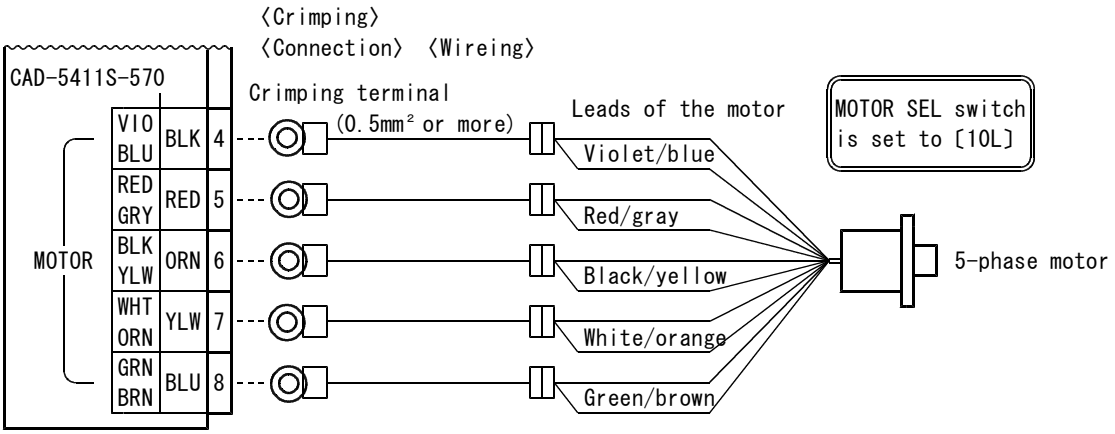
(3)Example of Connection with Motor output terminal

■SANYO DENKI Co., Ldt. (5 Leads)



・Color indications for the motor crimping terminals (4～8) represent colors of the leads of the motor.

■ORIENTAL MOTOR Co.,Ltd.(10 Leads)



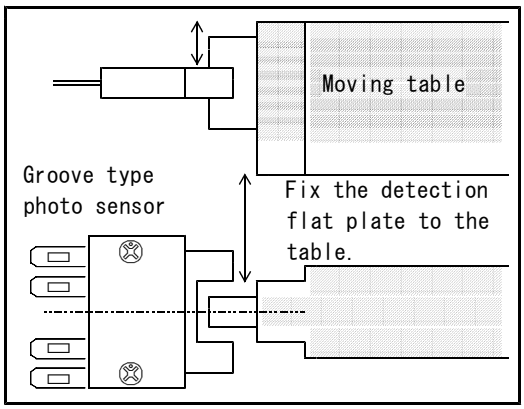
・Color indications for the motor crimping terminals (4～8) represent colors of the leads of the motor.

(4)Example of Connection with Sensor

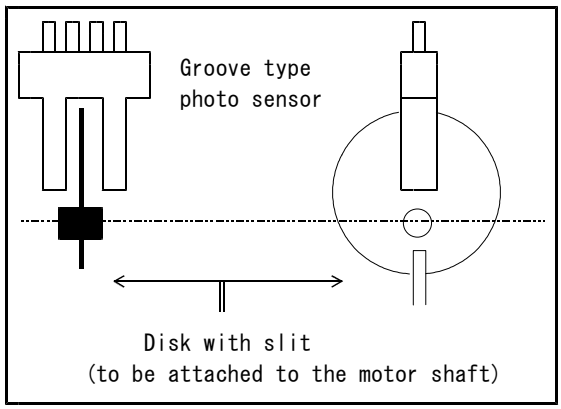
To prevent malfunction due to noise, separate connection to each sensor more than 50mm from the power cable and make the wiring distance less than 10m. When using any sensor other than our recommended ones, make sure that the sensor voltage specification is 24V.

■Example of Sensor Connection (In case of photo sensor)

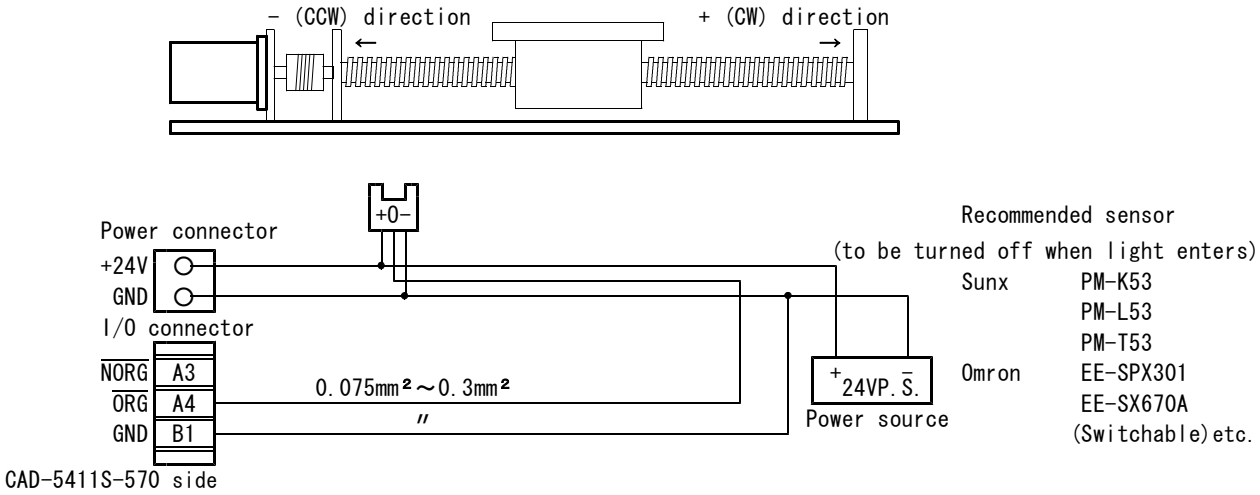
【Straight line system sensor(ORG, NORG, LIMIT)】



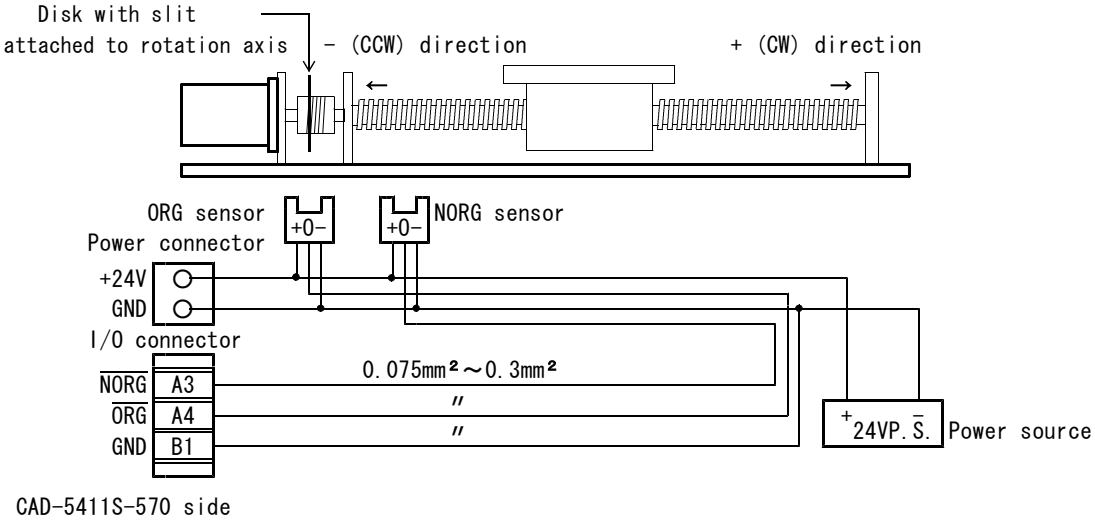
【Rotary system sensor (ORG)】



■In case of ORG-0, 1, 2, 3 (Detection with one sensor)



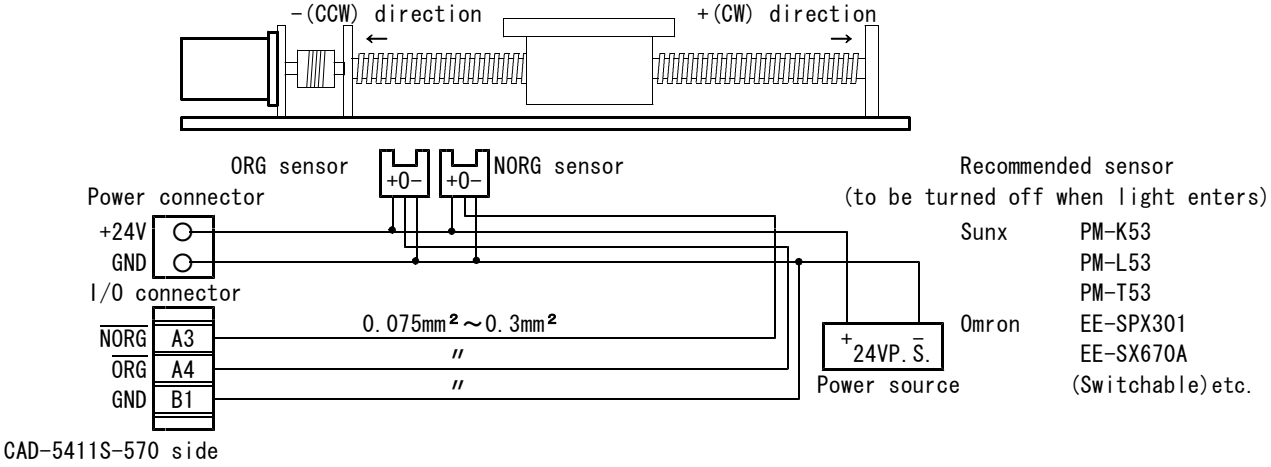
■In case of ORG-4, ORG-5 (Detection with two sensors)



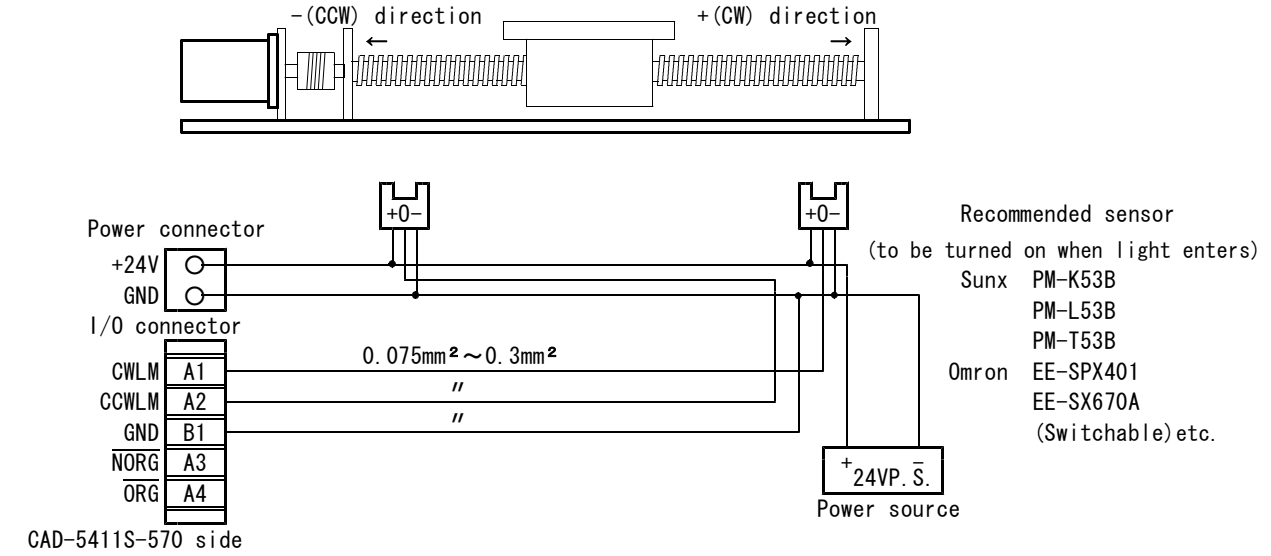
Recommended sensor

NORG sensor (to be turned off when light enters)		ORG sensor (to be turned on when light enters)	
Sunx	PM-K53	Sunx	PM-K53B
	PM-L53		PM-L53B
	PM-T53		PM-T53B
Omron	EE-SPX301	Omron	EE-SPX401
	EE-SX670A(Switchable), etc.		EE-SX670A (Switchable), etc.

■In case of ORG-10 (Detection with two sensors)

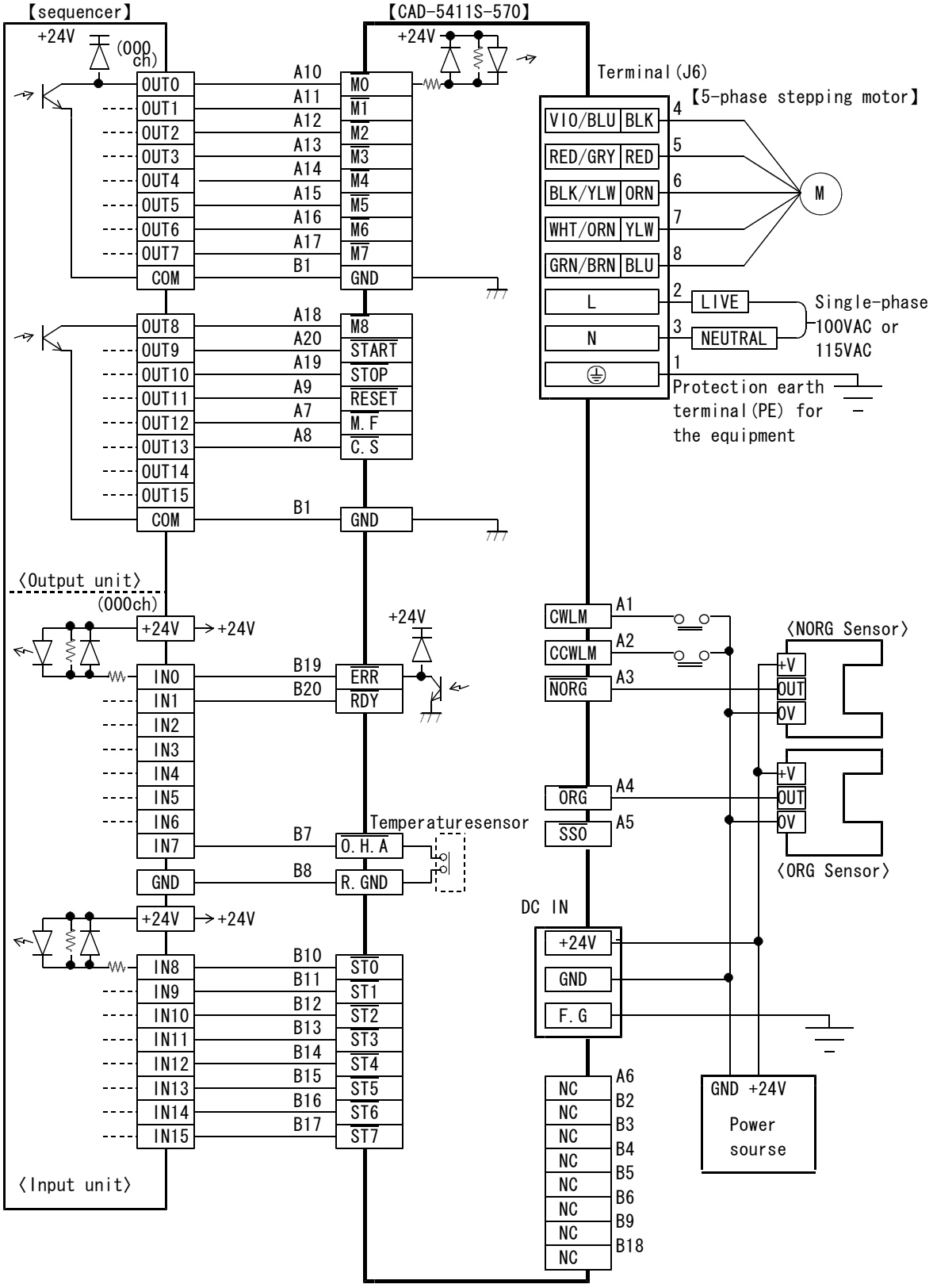


■In case of ORG-11, 12 (Both Limit Sensor and ORG Sensor are used.)



・Do not connect $\overline{\text{ORG}}$ signal and $\overline{\text{NORG}}$ signals except connection of CWLM and CCWLM.
・Limit signal is of active off (B contact) input.
If CAD-5411S-570 signal input is not connected to GND even when Limit Signal is not used, pulse output is not available.

(5)Example of Total Connection



・In the normal mode of CAD-5411S-570 External, when not carrying out data setup from I/O, and the present value address read-out, the I/O mark of a sequencer can be omitted.

3-5.Wiring Method

(1)Wiring of I/O signal connector

⚠ Caution

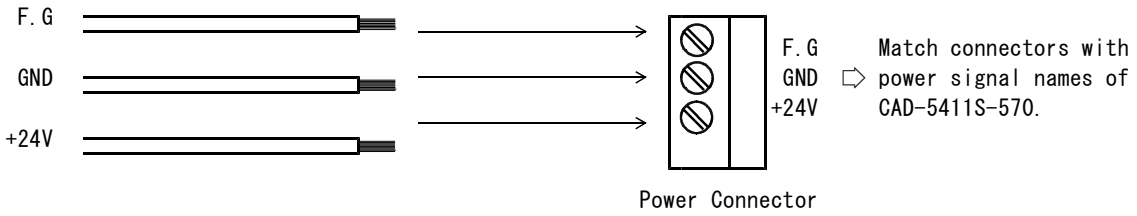
CAD-5411S-570 may be damaged.
Be careful not to wire I/O signal connector GND to any connector other than GND.
I/O signal connector return GND is connected to +24V power GND inside.

・Use wires between AWG28 (0.075mm²) and AWG22 (0.3mm²) to connect necessary signal cables to the I/O signal connectors.

(2)Wiring of Power Connector for controller

⚠ Caution

CAD-5411S-570 may be damaged.
Pay attention to power supply polarity in wiring.



1 Applicable wires are AWG20 (about 0.5mm²)～ AWG12 (about 3.2mm²). Prepare two wires up to AWG15 (about 1.5mm²) for 2-wire connection (daisy chain) and remove the cover 5mm～7mm from the tips with a special tool like stripper.

2 Before inserting signal cables, fully loosen the signal cable fixing screws of the accessory connectors. When signal cables are inserted in the loosening direction (rear space) contrary to the tightening direction, they cannot be tightened firmly.

3 Insert three power cables in holes of accessory connectors to the end paying attention to the direction of accessory connectors and polarity of the power cable.
At the time of daisy chain connection, twist same power cables together first and insert the two cables (of the same polarity).

4 Tighten each power cable firmly with the signal cable fixing screw at the accessory connector. (Turn the screw clockwise to fix the cable.)

REFERENCE

・The following screwdriver is available especially for connectors:
Omron product: Type XW4Z-00C
・Crimped terminal for wire is as follows:
Phoenix Contact product: AI Series
Crimped terminal Wire

・The dedicated crimping tool is as follows:
Phoenix Contact product: Type ZA3
●For the detail, contact each maker

(3)Wiring of Terminal block for driver

⚠ WARNING	Potential electrical shock is apprehended. Turn the main power off.

⚠ WARNING	Potential electrical shock is apprehended. Securely ground the protection earth terminal(⏚).

⚠ WARNING	Potential electrical shock or fire is apprehended. Do not force the power line or the motor line to be bent or pulled or pinched.

⚠ Caution	Erroneous connection may result in breakage of the motor. Correctly connect the motor wiring.

The following items are required.
- Crimping terminal (TMEV1.25-3 : Nichifu or the equivalent) …… 8
- Manually operated crimping tool for AWG22-16
  (NH-11 : Nichifu or the equivalent) …… 1

1 Turn power of the equipment [off] .

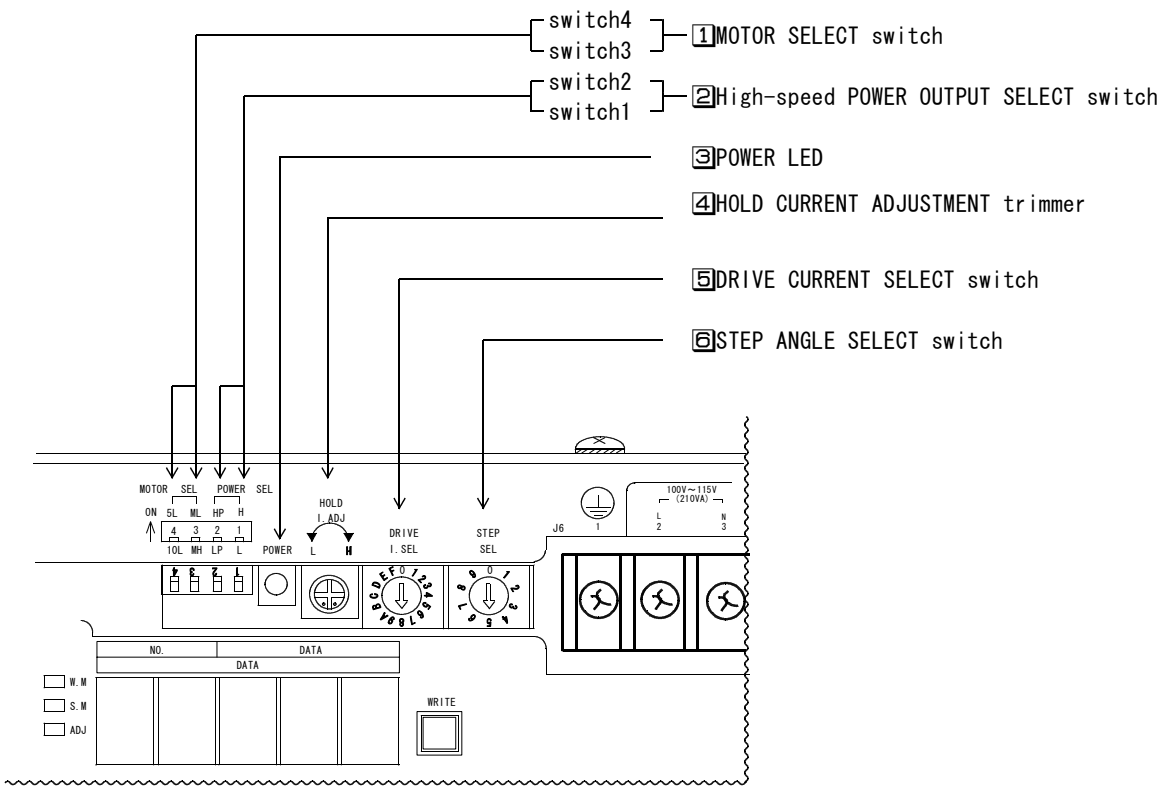
2 Crimp the crimping terminal to the cable used for wiring.

3 Remove the cover of the terminal block, then connect.

4 Fix the terminal block cover after completing connection.

4. Setup for Driver Section

4-1.Panel View



Sign	Name of Signal	Name of operating section	Function	Setting upon shipping
1	MOTOR SEL	MOTOR SELECT switch	Selects the applicable switch.	〔MH・5L〕
2	POWER SEL	High-speed POWER OUTPUT SELECT switch	Selects high-speed torque for the motor.	〔HP・H〕
3	POWER	—	POWER LED comes on upon inputting power. POWER LED goes off when internal voltage drops to 40V or lower after turning off power.	—
4	HOLD I.ADJ	HOLD CURRENT ADJUSTMENT trimmer	Adjusts HOLD current.	〔40%〕
5	DRIVE I.SEL	DRIVE CURRENT SELECT switch	Selects DRIVE current.	〔No.F〕
6	STEP SEL	STEP ANGLE SELECT switch	Selects a STEP angle.	〔No.6〕

4-2.Setting MOTOR SELECT switch

⚠ Caution

Erroneous setting may cause burn on the skin due to overheating of the motor.
Ensure correct setting.

The MOTOR SEL switch is turned to the setting corresponding to the motor in use.
Set this switch with power off.
It is set to 【MH･5L】upon shipping.

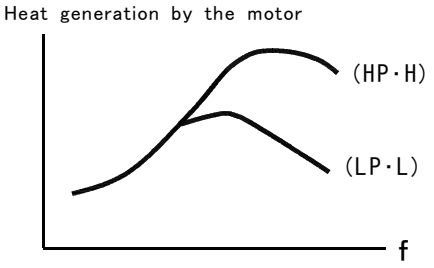
- ･Turn power【OFF】.
- ･Turn switches 3(MH/5L) and 4(10L/5L) to the settings specified in the table 「2-2.(2) Applicable Motors」.

4-3.Setting High-speed POWER OUTPUT SELECT switch

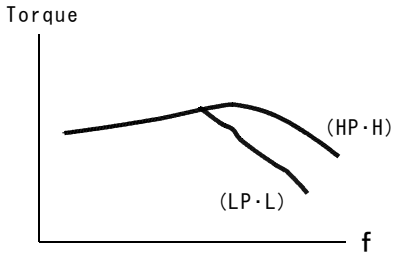
Output by high-speed torque can be selected with the POWER SEL switch.
There are four types of high-speed torque options.
It is set to 【HP･H】upon shipping.

- ･Turn the switch 1(L/H) and 2(LP/HP) to the setting for high-speed torque required.

■Relationships of the switch setting and heat generation by the motor and high-speed torque.



Heat Generation Model



Torque Model

■Select the switch (HP･H) if high-speed torque is required, and one from the switches (HP･L) through (LP･L) if not, in order to control heat generation by the motor.

■Selecting one of the switches leads to power demand as shown below.

Switch setting	HP･H	HP･L	LP･H	LP･L
Power Demand (with DRIVE I.SEL No.F set up)	210VA	170VA	140VA	110VA

(upon shipping)

4-4.Setting DRIVE CURRENT SELECT switch

⚠ Caution

Erroneous setting may cause burn on the skin due to overheating of the motor.
Ensure correct setting.

DRIVE current is set up with the DRIVE I. SEL switch.
It is set to 【No.F】upon shipping.

・Set the switch No. to the setting specified in the table 「2-2.(2) Applicable Motors」.

■Relationship between the DRIVE I.SEL switch and DRIVE current.

MOTOR SEL switch is set to [5L]	
switch No.	A/phase
0	0.17
1	0.20
2	0.24
3	0.27
4	0.31
5	0.34
6	0.37
7	0.41
8	0.44
9	0.48
A	0.51
B	0.54
C	0.58
D	0.61
E	0.64
F	0.68

(upon shipping)

MOTOR SEL switch is set to [10L]	
switch No.	A/phase
0	0.34
1	0.40
2	0.47
3	0.54
4	0.61
5	0.67
6	0.74
7	0.81
8	0.88
9	0.95
A	1.01
B	1.08
C	1.15
D	1.21
E	1.28
F	1.35

(upon shipping)

4-5.Setting STEP ANGLE SELECT switch

⚠ Caution

Erroneous setting may cause breakage of the machine or injury due to unexpected rotation of the motor.
Ensure correct setting.

The STEP angle is set up with the STEP SEL switch.
The STEP angle can be selected from ten different types of STEP angle.
Set this switch with power off.
It is set to 【No.6】upon shipping.

・Turn power【OFF】.
・Set the switch No. to the STEP angle required.

■Relationship between the STEP SEL switch No. and the STEP angle.

Switch No.	Number of Divisions	Step angle(°)	
		0.72° motor	0.36° motor
0	1/1	0.72	0.36
1	1/2	0.36	0.18
2	1/4	0.18	0.09
3	1/8	0.09	0.045
4	1/10	0.072	0.036
5	1/16	0.045	0.0225
6	1/20	0.036	0.018
7	1/40	0.018	0.009
8	1/80	0.009	0.0045
9	1/160	0.0045	0.00225

(upon shipping)

■Two types of STEP drive are provided by combining the STEP SEL switch setting and the $\overline{C.S}$ signal.

4-6.Setting HOLD CURRENT ADJUSTMENT trimmer

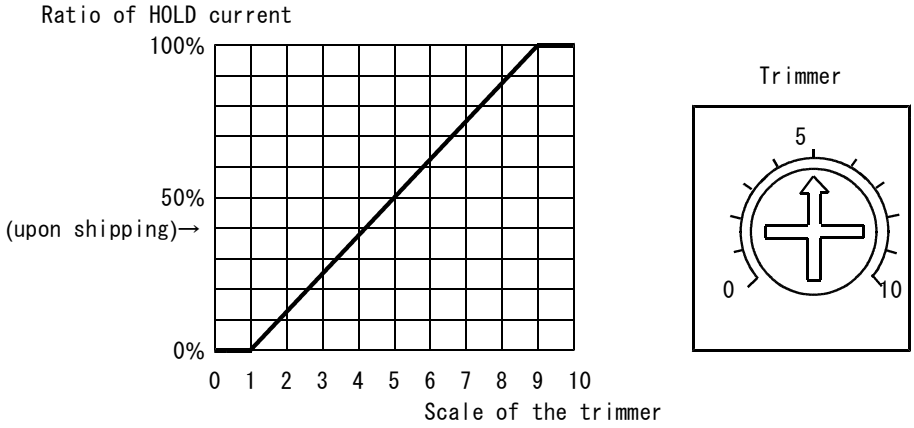
> ⚠ Caution
>
> A high setting value may cause burn on the skin due to overheating of the motor.
> Do not select a high value beyond the required.

HOLD current is set up with the HOLD I. ADJ trimmer.
This sets the ratio of HOLD current to DRIVE current.
The ratio is adjustable between 0 to 100%.
It is set to 40% upon shipping.

・Set the gauge of the trimmer to the required value.

■Relationship between the trimmer scales and HOLD current.

$$\text{Ratio of HOLD current}(\%) = \frac{\text{HOLD current}}{\text{DRIVE current}} \times 100$$



■HOLD current changes relative to the DRIVE current setting.
The ratio of HOLD current of 100% represents the same as the setting for DRIVE current.

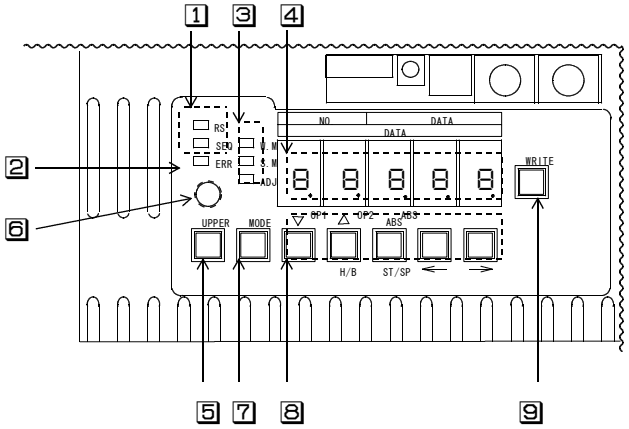
■The greater the ratio of HOLD current grows, the more heat the motor generates when turned off.

4-7.The check item before a power supply input

Point	No.	Contents	Result
Installation	1	Did you install the controller by fixing with screws according to the installing method?	Yes , No
	2	Does it have an installation interval according to the installation method?	Yes , No
Setup of driver section	3	Did you set up the motor selection switch suitable for the application motor?	Yes , No
	4	Did you set up the high-speed POWER selection switch from high-speed torque and motor generation of heat?	Yes , No
	5	Did you set up the DRIVE current selection switch suitable for the application motor?	Yes , No
	6	Did you set up the step angle of a motor with a step angle selection switch?	Yes , No
	7	Did you checked the setting state of a HOLD current adjustment trimmer's scale?	Yes , No
Wiring	8	Did you connect connectors and cables to CAD-5411S-570?	Yes , No
	9	Aren't wires and cables short-circuited or disconnected?	Yes , No
	10	Are I/O connection cables correctly connected?	Yes , No
	11	Is the power source polarity correct in wiring to the power connector for controller?	Yes , No
	12	Did you check if I/O signals are correctly wired?	Yes , No
	13	Are wire thickness appropriate to the total current consumption of the power supplying CAD-5411S-570?	Yes , No
	14	Are wire thickness satisfying the specification used for terminal wiring of I/O signals?	Yes , No
	15	Is the controller wired more than 50mm away from the power cable and the high-tension cable?	Yes , No
	16	Are I/O signals wired to the sequencer within 10m from sensors?	Yes , No
	17	Is the controller free from stress to connectors and tension of wire?	Yes , No
Inspection of foreign matters	18	After completion of installation and wiring, did you check that the CAD-5411S-570 is free from foreign matters like wire chips?	Yes , No
Power source capacity	19	Do you calculate the power source capacity from number of units connected and current consumption?	Yes , No
	20	Do you consider rush current at the time of starting for current capacity?	Yes , No
Grounding	21	Did you checked that the protection earth terminal was wired certainly?	Yes , No

5. DISPLAYS AND PROGRAMMING for Controller

5-1.Panel Overview



Sign	Name of Signal	Function
1	RS/SEQ LED	Displays externally controlled statuses.
2	ERR LED	Lit when the CAD-5411S-570 detects an error.
3	MODE LED	Displays the mode selected with the MODE key.
4	No./DATA segment LEDs	Display numbers and data using its upper or lower five digits.
5	UPPER key	Toggles the display mode between the upper five digits and the lower five digits.
6	OP0/OP1/OP2 key	Used to select an operation mode.
7	MODE key	Used to select a mode.
8	Programming/Data Operation keys	Used to program or operate data.
9	WRITE key	Used to load programmed data to the CAD-5411S-570 (EEROM).

5-2.Panel Description

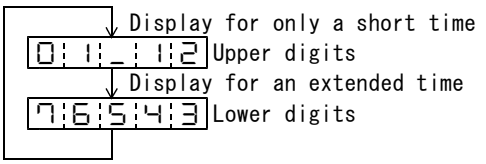
Use the 7-segment LEDs 4 and keys 8 as described below.

(1)Views in External Modes

In External Modes (EXT)、the view is in the Upper-/Lower-5-Digit Auto-Switching Mode.

■ When UPPER key is pressed, the view is fixed to the Upper-5-Digit Mode.

□ When the UPPER key is released, the view is in the Upper-/Lower-5-Digit Auto-Switching Mode.



(2)Views in Panel Modes

The view when programming data in a Panel Mode is fixed to either Upper- or Lower-5-Digit mode.

■Fixed to upper digits with UPPER key turned on. Upper digits

□Fixed to lower digits with UPPER key turned off. Lower digits

(3)Using panel keys

When entering or operating numbers or data,select the upper digits or lower digits by holding down or releasing UPPER key 5.

・Using the key 8 while holding down UPPER key changes an upper 5-digit number or data. (The view with UPPER key held down is consistent with those digits valid for the key in terms of the upper digits.)

・Using the key 8 without pressing UPPER key changes the view to lower 5 digit data. (The view with UPPER key not held down is consistent with those digits valid for the key in terms of the lower digits.)

REFERENCE

For how to operate the panel,see Section 5-5. "Operation via Panel."

5-3.List of Write Data Entries

⚠ Caution

Mechanical damage or personal injury may occur.
Whenever you change DRIVE TYPE, be sure to re-enter speed data.
The output speed will be changed in response to the range of DRIVE TYPE (Write Data No.A1).

Any data entry that is required to operate the CAD-5411S-570 is indicated by a ♦ on the left-side margin. Be sure to enter them.
Description for legends: 「○」, 「×」and 「△」 in OP0, OP1, and OP2 columns「○」 indicates both data reference and entry are available; 「×」 indicates neither data reference nor entry is available; 「×」 indicates only data reference is available.

	Item	No.			Description and Setting Range	Factory Setting	OP0	OP1	OP2
	INDEX ALL HSPD	A	L	H	Used to enter the same value for all maximum speed values (HSPD) applied to INDEX00 through INDEX49 and INDEX50 in one step.	3000Hz	×	○	△
♦	Distance for INDEX00 (INDEX to use)	0	0		Sets the index type of INDEX00 DRIVE (INCREMENTAL or ABSOLUTE) and the distance to move (or target address).	INCREMENTAL 4000PULSE	○	○	△
♦	INDEX00 HSPD (INDEX to use)	0	0	H	Sets the maximum speed (HSPD) for INDEX00 DRIVE and RTN DRIVE.	3000Hz	×	○	△
	Distance for INDEX01	0	1		Sets the index type of INDEX01 DRIVE (INCREMENTAL or ABSOLUTE) and the distance to move (or target address).	INCREMENTAL 4000PULSE	○	○	△
	INDEX01 HSPD	0	1	H	Sets the maximum speed (HSPD) for INDEX01 DRIVE.	3000Hz	×	○	△
	Distance for INDEX49	4	9		Sets the index type of INDEX49 DRIVE (INCREMENTAL or ABSOLUTE) and the distance to move (or target address).	INCREMENTAL 4000PULSE	○	○	△
	INDEX49 HSPD	4	9	H	Sets the maximum speed (HSPD) for INDEX49 DRIVE.	3000Hz	×	○	△
	Distance for INDEX50	5	0		Sets the index type of INDEX50 DRIVE (INCREMENTAL or ABSOLUTE) and the distance to move (or target address).The distance can be rewritten by transferring data from I/O.(The data transferred will be retained until power is turned off or $\overline{\text{RESET}}$ is entered.)	INCREMENTAL 4000PULSE	○	○	△
	INDEX50 HSPD	5	0	H	Sets the maximum speed (HSPD) for INDEX50 DRIVE. HSPD can be rewritten by transferring data from I/O.(The data transferred will be retained until power is turned off or $\overline{\text{RESET}}$ is issued.)	3000Hz	×	○	△
	Distance for SENSOR DRIVE	9	0		Sets the distance for SENSOR DRIVE.	4000PULSE	○	○	△
	SENSOR HSPD	9	0	H	Sets the maximum speed (HSPD) for SENSOR DRIVE.	3000Hz	×	○	△
♦	Drive type for DRIVE	A	0		Sets the acceleration/deceleration driving type for INDEX00 through INDEX50 DRIVE. 0 = Trapezoidal Drive, 1 = S-Curve Drive	0 = Trapezoidal Drive	×	○	△
♦	DRIVE TYPE	A	1		Establishes the range for rates and speeds (LSPD, HSPD, and CSPD). 0=L-TYPE 1=M2-TYPE(RESOLUTION_20) 2=H-TYPE 3=M1-TYPE(RESOLUTION_10)	0=L-TYPE	×	○	△
♦	STOP TYPE	A	4		Sets the stop type by $\overline{\text{STOP}}$ signal. 0 = Decelerating Stop (no error outputs, status 32H, REST DRIVE enabled) 1 = Immediate Stop (error status 02H output, REST DRIVE disabled) 2 = Immediate Stop (no error outputs, status 4EH, REST DRIVE disabled)	0 =Decelerating Stop	×	○	△
	SENSOR DRIVE TYPE	A	5		Sets the type of SENSOR DRIVE that decelerates and stops the motor with a sensor input. 0=TYPE0 1=TYPE1 4=TYPE4	0=TYPE0	×	○	△

	Item	No.	Description and Setting Range	Factory Setting	OP0	OP1	OP2
	Millimeter (angular) conversion constant	A6	Set a constant that converts a distance per pulse to linear motion (in millimeters) or rotary motion (in degrees) in 0.01μm or 0.00001 degrees, respectively. 0 to 99999 (when set to 0, a distance in pulses is used with no conversion applied)	0 (Unit: Pulse)	×	○	△
	EXTERNAL DISPLAY	A7	Select the type of data to be displayed on the panel in an External Mode. 0 = Address of current position (real-time display) 1 = Distance for INDEX00 to INDEX50 (or target address)	0 = Address of current position	×	○	△
♦	DELAY TIME	A8	Sets the delay time inserted between the moment a $\overline{START}$ signal is issued and the moment a motion signal ($\overline{M0}$ to $\overline{M8}$) is read in 0.1ms. 1 to 30 (0.1ms to 3ms)	30(3ms)	×	○	△
	Status at mode switching	A9	Sets how to output statuses when switching an External Mode to W. Mode (S. Mode). 0 = Status with the motor controlled in an External Mode is retained (allows continued motion control when data was changed). 1 = Output an ERR status (errors are determined by a host)	0 = Status with the motor controlled in an External Mode is retained.	×	○	△
♦	ORG TYPE	b0	Set the type of ORG(machine home detection) DRIVE. 0=ORG-0 1=ORG-1 2=ORG-2 3=ORG-3 4=ORG-4 5=ORG-5 6=ORG-10 7=ORG-11 8=ORG-12	3=ORG-3	×	○	△
	HIGH SPEED ORG	b1	Set whether to shorten the time required to detect ORG DRIVE. 0 = Not shorten (ORG sensor is detected at HSPD) 1 = Shorten(detect the moment the motor moves to machine home + offset at HSPD)	1 = Shorten	×	○	△
♦	ORG DIRECTION	b2	Set the direction to detect ORG DRIVE in accordance with the longitudinal relationship of the machine home. 0 = CCW (-) direction: 1 = CW (+) direction	0 = CCW (-) direction	×	○	△
	PRESET DIRECTION	b3	Set the direction of PRESET DRIVE to automatically move the motor in a given direction after the machine home is detected with ORG DRIVE. 0 = CCW (-) direction 1 = CW (+) direction	1=CW (+) direction	×	○	△
	Preset pulses	b4	Set the number of pulses for PRESET DRIVE to automatically move the motor in a given direction after the machine home is detected with ORG DRIVE. 0～8,388,607PULSE	0 pulses no PRESET DRIVE applied)	×	○	△
	MARGIN TIME	b5	Set a margin time before the pulse output stops when hunting occurs with the sensor detection in the ORG detection process. 0 to 255 (0 to 51ms, in 0.2ms) Example: 0 ····· No margin time 10 ····· 2ms 255 ····· 51ms	0ms (No margin time)	×	○	△
	Offset	b6	Set an address adjacent to the machine home(machinehome + offset) when "b1" has been set to shorten the ORG detection time. 0～255PULSE	0PULSE	×	○	△

	Item	No.	Description and Setting Range	Factory Setting	OP0	OP1	OP2
	Enable or disable Shortest-Distance Indexing	C0	Enable or disable Shortest-Distance Indexing when controlling the rotation system. 0 = Disable: 1 = Enable	0 = Disable	×	○	△
	Number of pulses per revolution for Shortest-Distance Indexing	C1	Set the number of pulses per revolution when No.C0 has been set to enable Shortest-Distance Indexing. 1～8,388,607PULSE	4000PULSE	×	○	△
	RTN DRIVE direction for Shortest-Distance Indexing	C2	Set the direction for RTN DRIVE that takes the shortest path when No.C0 has been set to enable Shortest-Distance Indexing. 0 = RTN DRIVE taking the shortest path 1 = CW (+) RTN DRIVE 2 = CCW (-) RTN DRIVE	0 =RTN DRIVE taking the shortest path	×	○	△
♦	ORG HSPD	d0	Set the maximum speed(ORG HIGH SPEED) at which ORG DRIVE is executed in the External Normal Mode or via the panel.	3000Hz	×	○	△
	ORG TSPD	d1	Set the speed (ORG TEACHING SPEED) at which an ORG DRIVE is executed at a safe speed when operating the motor in the External Teaching or External Trace Mode or at which the motor is operated in the teaching mode via the panel.	1000Hz	×	○	△
♦	ORG LSPD	d2	Set the self-start speed (ORG LOW SPEED) at which ORG DRIVE is activated.	500Hz	×	○	△
♦	ORG RATE	d3	Set the acceleration/deceleration constant (RATE DATA TABLE No.) for ORG DRIVE.	No.＝9 100ms /1000Hz	×	○	△
♦	ORG CSPD	d4	Set the constant detection process speed (ORG CONSTANT SPEED) for ORG DRIVE.	500Hz	×	○	△
♦	SCAN HSPD (when SCAN used)	E0	Set the maximum travel speed (SCAN HIGH SPEED) at which M. SCAN DRIVE is executed in the External Normal or External Teaching Mode or SPECIAL SCAN DRIVE is activated via ⇦⇨ key on the panel.	3000Hz	×	○	△
	SCAN TSPD	E1	Set a safe speed (SCAN TEACHING SPEED) at which T.M.SCAN DRIVE (a DRIVE for teaching use) is executed in the External Teaching Mode (T.M SCAN DRIVE is provided independently from M. SCAN DRIVE).	3000Hz	×	○	△
♦	SCAN LSPD (when SCAN used)	E2	Set the self-start speed (SCAN LOW SPEED) at which (T.) M. SCAN DRIVE is executed in the External Normal or External Teaching Mode or SPECIAL SCAN DRIVE is activated via ⇦⇨ key on the panel.	500Hz	×	○	△
♦	SCAN RATE (when SCAN used)	E3	Set the acceleration/deceleration constant (RATE DATA TABLE No.) for (T.) M. SCAN DRIVE in the External Normal or External Teaching Mode or SPECIAL SCAN DRIVE that is activated via ⇦⇨ key on the panel.	No.＝9 100ms /1000Hz	×	○	△
♦	SCAN CSPD (when SCAN used)	E4	Set the constant speed (SCAN CONSTANT SPEED) at which M. SCAN DRIVE is executed in the External Normal or External Teaching Mode.	500Hz	×	○	△

®1

	Item	No.	Description and Setting Range	Factory Setting	OP0	OP1	OP2
	INDEX TSPD	F 1	Set a safe speed (INDEX TEACHING SPEED) at which INDEX DRIVE or RTN DRIVE is executed when operat ingthe motor in the External Trace Mode or in Teaching Mode via the panel.	1000Hz	×	○	△
♦	INDEX LSPD	F 2	Set the self-start speed (INDEX LOW SPEED) when activating INDEX00 to INDEX50, RTN,or SENSOR DRIVE s'.	500Hz	×	○	△
♦	INDEX RATE	F 3	Sets the acceleration/deceleration constant (Rate Data Table No.) for INDEX00 to DRIVE50, RTN, and SENSOR DRIVEs'.	9 100ms /1000Hz	×	○	△
	TEACHING OFFSET DIRECTION	F 4	Set the direction to move the motor to relative positions(compensation of coordinates) when positi oning is done by intentionally moving the motor to positions relative to those positions programmed through teaching. 0 = CCW (-) direction: 1 = CW (+) direction	1＝CW +) direction	×	○	△
	Teaching Offset	F 5	Set the number of pulses to move the motor to rela tive positions (compensation of coordinates) when positioning is done by intentionally moving the motor to positions relative to those positions pro grammed through teaching. 0～8,388,607PULSE	0 pulses (no compensa tion of coor dinates)	×	○	△
	RS232C RATE *1	F 6	Set the transfer rate (baud rate) for the RS232C. 0＝9600bps 1＝19200bps 2＝38400bps 3＝57600bps	3＝57600bps	×	○	△

・*1: When a setting change of the transfer rate (baud rate) of No.F6 is made, the setup becomes effective from starting after CAD-5411S-570 carries out power supply(+24V) off (or $\overline{\text{RESET}}$).

・To apply the S-Curve Drive to INDEX00 to INDEX50 DRIVEs', set Write Data No. A0 to 1. When it is set as driven in a trapezoidal profile for INDEX00 to INDEX50 DRIVEs', two of the Panel Modes, S-Curve Data Reference and Programming, and two of the External Modes (I/O data transfer), S-Curve Programming and Reading, are disabled.

・The distance for INDEX50 and HSPD data transferred from the sequencer I/O is maintained until power is turned off or a $\overline{\text{RESET}}$ is entered. Data transfer is not required at every motion step unless the data is changed.
On power up or $\overline{\text{RESET}}$ input, the controller is activated with the data stored in the EEROM.

・The INDEX ALL HSPD is an auxiliary function used to enter the same value in HSPD applied to all INDEX motions in one step.
It is useful when changing HSPD for some INDEX motions after setting an HSPD shared by multiple INDEX motions in one step.

5-4.List of S-Curve Data Entries

> ⚠ **Caution**
>
> SCSPD1 and SCSPD2 data in the S-Curve data may be overwritten.
> Whenever you change DRIVE TYPE, HSPD or LSPD, re-adjust or re-enter SCSPD1 and/or SCSPD2 data if necessary.
> If DRIVE TYPE (Write Data), HSPD or LSPD is changed when the S-Curve Drive is selected, both SCSPD1 and SCSPD2 data will be automatically updated.

When applying the S-Curve Drive to INDEX00 to INDEX50 DRIVEs', a minimum number of parameters required for it have been automatically set.
It is, therefore, not necessary to set the S-curve data.
When the S-Curve Drive needs fine adjustments, set the following S-curve data.
To externally set or read S-curve data or to do the same via the panel, it is required to preset Write Data No. A0 to 1.

Description for legends: 「○」,「×」and「△」in OP0, OP1, and OP2 columns
「○」indicates both data reference and entry are available; 「×」indicates neither data reference nor entry is available; 「△」indicates only data reference is available.

Item	No.			Description and Setting Range	Factory Setting	OP0	OP1	OP2
ALL INDEX SCSPD1	A	L	1	Used to enter the same value for the rate at which linear acceleration starts and for the rate at which linear deceleration ends (SCSPD1) in one step when the S-Curve Drive is applied to INDEX00 through INDEX50.	1333Hz	×	○	△
ALL INDEX SCSPD2	A	L	2	Used to enter the same value for the rate at which linear acceleration starts and for the rate at which linear deceleration ends (SCSPD2) in one step when the S-Curve Drive is applied to INDEX00 through INDEX50.	2166Hz	×	○	△
INDEX00 SCSPD1	0	0	1	Set the rate at which linear acceleration starts and the one at which linear deceleration ends when the S-Curve Drive is applied to INDEX00 DRIVE.	1333Hz	×	○	△
INDEX00 SCSPD2	0	0	2	Set the rate at which linear acceleration ends and the one at which linear deceleration starts when the S-Curve Drive is applied to INDEX00 DRIVE.	2166Hz	×	○	△
INDEX49 SCSPD1	4	9	1	Set the rate at which linear acceleration starts and the one at which linear deceleration ends when the S-Curve Drive is applied to INDEX49 DRIVE.	1333Hz	×	○	△
INDEX49 SCSPD2	4	9	2	Set the rate at which linear acceleration ends and the one at which linear deceleration starts when the S-Curve Drive is applied toINDEX49 DRIVE.	2166Hz	×	○	△
INDEX50 SCSPD1	5	0	1	Set the rate at which linear acceleration starts and the one at which linear deceleration ends when the S-Curve Drive is applied to INDEX50 DRIVE.	1333Hz	×	○	△
INDEX50 SCSPD2	5	0	2	Set the rate at which linear acceleration ends and the one at which linear deceleration starts when the S-Curve Drive is applied toINDEX50 DRIVE.	2166Hz	×	○	△

Item	No.	Description and Setting Range	Factory Setting	OP0	OP1	OP2
INDEX SRATE TYPE	A:0	Set how to set SSRATE (S-curve starting rate) and SERATE (S-curve ending rate) for index motions. 0 =Disable(automatically set to the value eight times the index rate) 1 =Enable(set to the value of SSRATE for A1 and the value of SERATE for A2)	0=Disable	×	○	△
INDEX SSRATE	A:1	Set the time constant (Rate Data Table No.) to start S-curve acceleration and end S-curve deceleration for INDEX00 through INDEX 50 DRIVEs'.	No.=1 1000ms /1000Hz	×	○	△
INDEX SERATE	A:2	Set the time constant (RATE DATA TABLE No.) to end S-curve acceleration and start S-curve deceleration for INDEX00 through INDEX50 DRIVEs'.	No.=1 1000ms /1000Hz	×	○	△
SESPD	A:3	Set the constant speed (S-CURVEE END PULSE SPEED) at which END PULSE DRIVE is executed when the S-Curve Drive is applied to INDEX00 through INDEX50 DRIVEs'.	300Hz	×	○	△
END PULSE	A:4	Set the number of end pulses when the S-Curve Drive is applied to INDEX00 through INDEX50 DRIVEs'. 0～65,535PULSE	0PULSE	×	○	△

・ALL INDEX SCSPD1/SCSPD2 is an auxiliary function used to enter the same value for both SPSPD1 and SCSPD2 applied to S-CURVE INDEX motions in one step.
It is useful when changing SCSPD applied to some INDEX motions after setting SCSPD1/SCSPD shared by multiple INDEX motions in one step.

5-5.Operations Via Panel

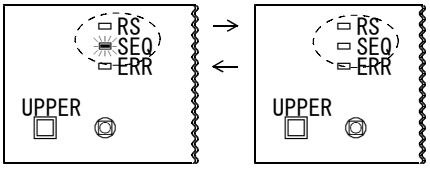
(1)Checking an External Mode is ready

In an External Mode, the LEDs remain ON when a selected control mode is ready (wait for command) and remain OFF when the controller is in operation in response to a command sent from a host or is communicating with other devices.

■SEQ Control Mode

SEQ LED remains ON when anSEQ Control Mode is ready.

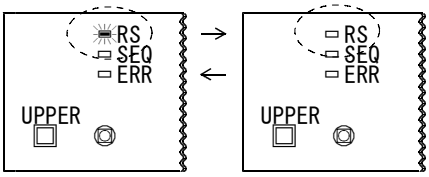
SEQ LED remains OFF when the controller is in operation.



■RS Control Mode

RS LED remains ON when the RS Control Modeis ready.

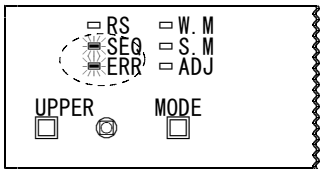
RS LED remains OFF during communication.

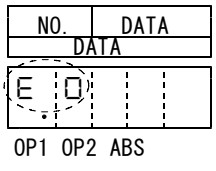


(2)Viewing error status (if an error occurs, the ERR LED turns on red)

■Error display in SEQ Control Mode

The following example demonstrates stopped with CCWLM.





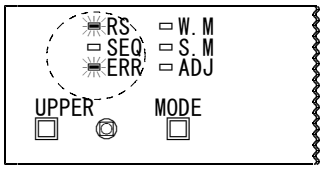
List of SEQ Control Mode Error Codes

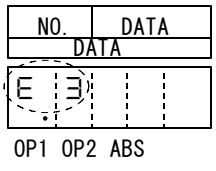
Error Code	Description
E0	CW (+) limit over error
E1	CCW (-) limit over error
E2	Motor stop caused by STOP (Immediate Stop)
E3	(Not used)
E4	Undefined motion was entered.
E5	External Mode switched to a Panel Mode (W. M. or S. M.)
E6	An error in the procedure for setting data from the external I/O.
E7	The internal hard error occurred.
E8	SENSOR DRIVE activated with Shortest-Distance Indexing enabled.
E9	An error occurred in REST DRIVE.
EA	Taught position out of ±8,388,607 range.

・For E5, it is possible to select whether to regard its status as an error depending on Write Data No.A9.

■Error display in RS Control Mode

When RS232C communication errors occur in an RS Control Mode, the relevant error codes appear. The following example demonstrates an undefined request received via an RS232C.



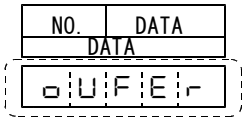


List of RS Control Mode Error Codes

Error Code	Description
E 1	Inconsistent slave address specified.
E2	Inconsistent slave type specified.
E3	Undefined request received.
E4	Request received when the controller was in a status other than Ready.
E5	Inconsistent axis specified.
E6	Inconsistent number specified for Index, Write Data, or S-Curve Data.
E7	Incorrectly specified data selection.
E8	Inconsistent data specified for Index, Write Data, or S-Curve Data.
E9	Incorrect request format.
EA	Request containing more than 80 bytes received.

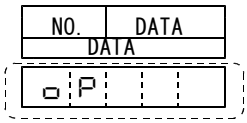
■Display when digits overflow

If the number of display digits for the current value for address is more than seven digits, "oVFEr" appears as shown below. If the display digits overflow, an $\overline{\text{ERR}}$ signal will not be turned on, the action being not interrupted. If the display digits are restored, the display returns to normal mode that shows the address of the current value.



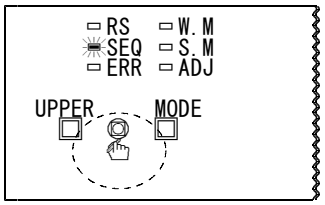
■Display with OP. MASK (operation mask) ON enabled

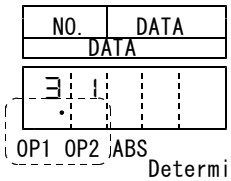
All panel key entries are disabled when the OP. MASK ON is activated in an External Mode.
When a key is pressed with the OP. MASK ON enabled, the following display appears to indicate that all panel key entries are disabled.



(3)Switching Operation Modes (OP MODE)

Every time you press OP0/OP1/OP2 key with a pen or the like, a Panel Mode changes.



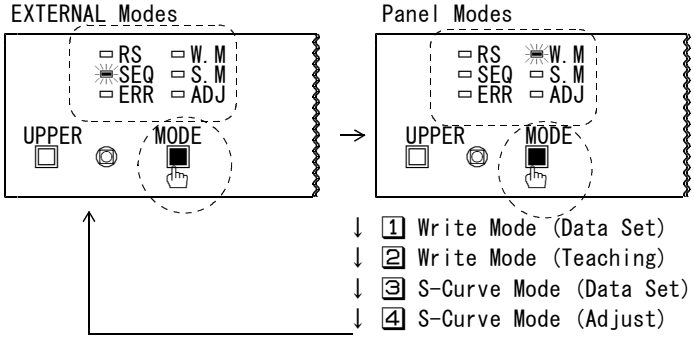


Determine the operating mode by checking the states of the two LEDs (● = On).

	OP1	OP2	
OP0 MODE	○	○	Limited to some data.
OP1 MODE	●	○	All pieces of data can be set.
OP2 MODE	○	●	Limited to data reference.

(4)Switching modes

The External (or Panel) Modes change from one to another in the sequence below when you press MODE key.


EXTERNAL Modes
Panel Modes
RS W.M
SEQ S.M
ERR ADJ
UPPER
MODE
↓ 1 Write Mode (Data Set) Only W.M LED lit
↓ 2 Write Mode (Teaching) Both W.M and ADJ LEDs lit
↓ 3 S-Curve Mode (Data Set) Only S.M LED lit
↓ 4 S-Curve Mode (Adjust) Both S.M and ADJ LEDs lit

・All of W.M , S.M and ADJ LEDs remain OFF in an External Mode.
・The mode selections vary depending on the drive type (Trapezoidal or S-curve) selected for the relevant operation mode and index motion.
Any unavailable Panel Mode is skipped, the display returning to the beginning of the External Modes.

No.	Panel Modes	OP0		OP1		OP2	
		Trapezoidal	S-Curve	Trapezoidal	S-Curve	Trapezoidal	S-Curve
1	Write Mode (Data Set)	○	×	○	○	△	△
2	Write Mode (Teaching)	×	×	○	○	△	△
3	S-Curve Mode (Data Set)	×	×	×	○	×	△
4	S-Curve Mode (Adjust)	×	×	×	○	×	△

○ :Data reference and programming enabled
× :Data reference and programming disabled
△ :Data reference enabled, but programming disabled

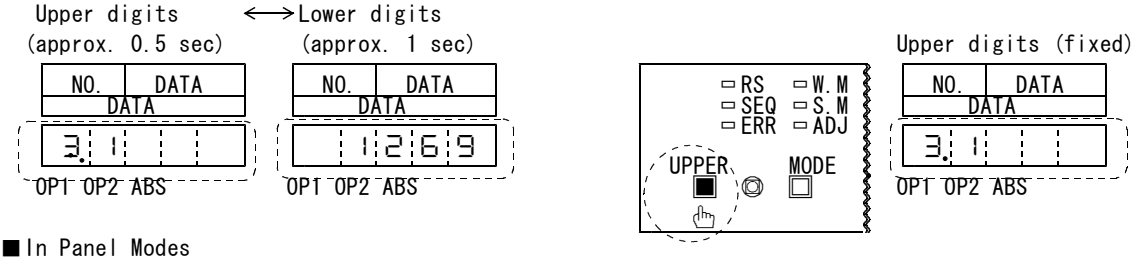
(5)Selecting data display digits

■In External Modes

The following example shows a case where INDEX31 is being driven and the current value is 1269.

・The display is normally in the Upper/Lower Digit Auto-Switching Mode.

・When UPPER key is pressed, the upper five digits are displayed.

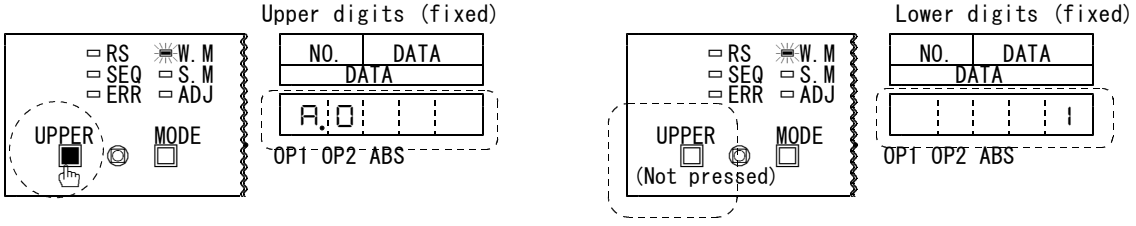


■In Panel Modes

The following example shows a case where Write Data No. A0 (DRIVE TYPE) is set to 1 (S-Curve).

・When UPPER key is pressed:
Fixed to the upper digits (No./Data).
When UPPER key is released, the display returns to the Lower Digits Mode.

・When UPPER key is released:
Fixed to the lower digits (Data).



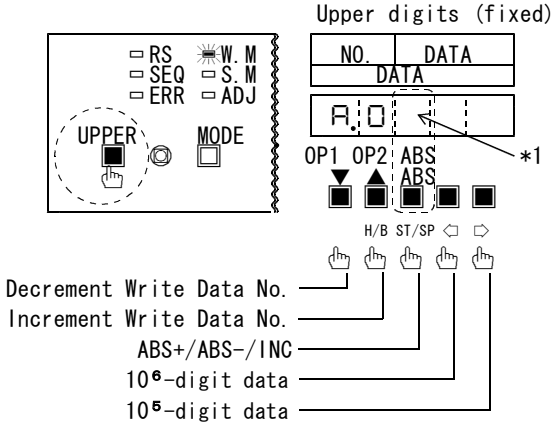
(6)Programming in Write Mode (W. M)

Select Write Mode with MODE key.

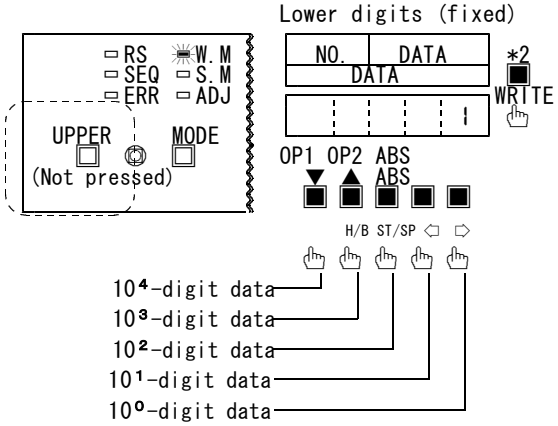
In the Write Mode, enter the parameters required to operate the CAD-5411S-570.

The following example shows a case where Write Data No. A0 (DRIVE TYPE) is set to 1 (S-Curve).

・When UPPER key is pressed:



・When UPPER key is released:



*1 Every time ABS key is pressed, the display changes in the sequence below.

" . " (blank + dot): +Absolute

" - ." (minus + dot): -Absolute

" " (blank) : Incremental

*2 When WRITE key is pressed, Data Write is executed. Approximately one second later, the Write Data No. is automatically incremented.

Press WRITE key while holding down UPPER key only when entering all HSPD values in one step.

(7)Setting the current value for address in Teaching Mode via panel

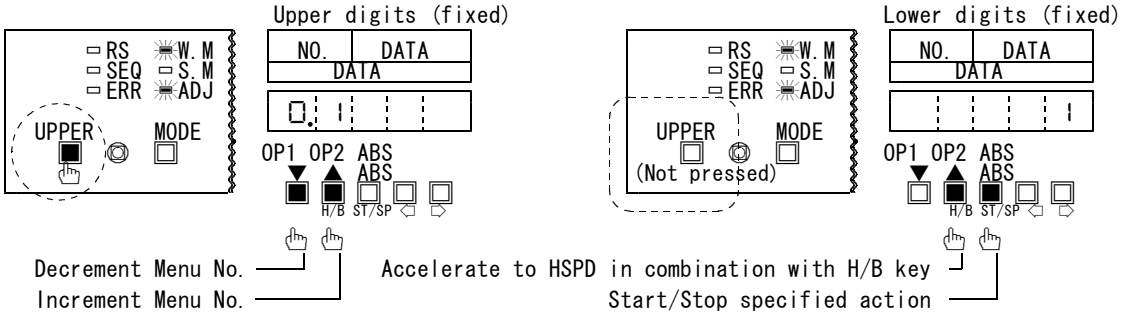
Select Write Mode (Teaching) with MODE key.
Shown below are Teaching (Panel Mode) menu numbers and the actions executed.

MENU No.	ST/SP key	H/B key	WRITE key
or	Execute/Stop ORG DRIVE	ON : HSPD speed OFF: TSPD speed	—
rP	Execute/Stop RTN DRIVE	ON : HSPD speed OFF: TSPD speed	R.P. SET motion
00	Execute/Stop INDEX00 DRIVE	ON : HSPD speed OFF: TSPD speed	Write the current value for address to INDEX00.
01	Execute/Stop INDEX01 DRIVE	ON : HSPD speed OFF: TSPD speed	Write the current value for address to INDEX01.
49	Execute/Stop INDEX49 DRIVE	ON : HSPD speed OFF: TSPD speed	Write the current value for address to INDEX49.
50	Execute/Stop INDEX50 DRIVE	ON : HSPD speed OFF: TSPD speed	Write the current value for address to INDEX50.

■Starting and stopping ORG DRIVE, RTN DRIVE and INDEX DRIVE functions
The following example shows a case where INDEX01 is selected.

・When UPPER key is pressed:
Select the number assigned to your desired action menu.

・When UPPER key is released:
Execute the action assigned to the selected menu number.

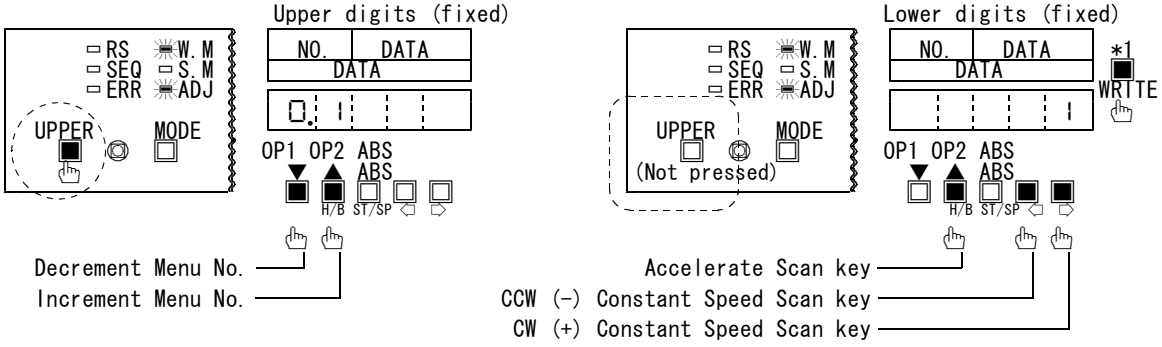


・ST (Start) key is enabled with UPPER key turned off, whereas SP(Stop) key operates irrespective of whether UPPER is turned on or off.
・When H/B key is turned on alone with UPPER key turned off, the current value appears.

■Setting address of current value
The following example shows a case where the address of current value for INDEX01 is set to 1.

・When UPPER key is pressed:
Select the number assigned to your desired action menu.

・When UPPER key is released:
Move to the taught point

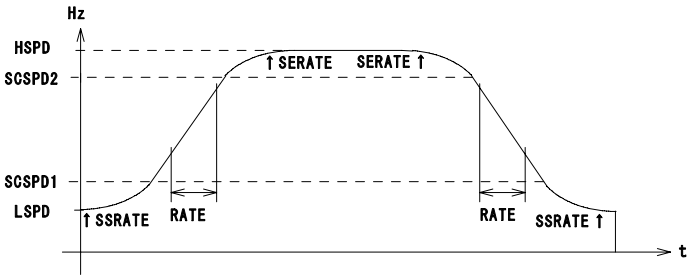


*1 When you press WRITE key, the address of the current value is written to the INDEX number specified with the menu number.
Approximately one second later, the menu number is automatically incremented.

・When H/B key is turned on alone with UPPER key turned off, the current value appears.
・Momentarily pressing SCAN key activates a JOG DRIVE.
・The use of Constant Speed Scan ⟸⟹ in combination with H/B key activates a SCAN DRIVE that accelerates up to HSPD.

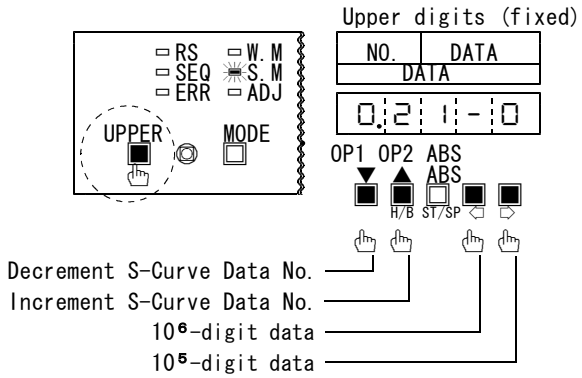
(8)Programming in S-Curve Mode (S. M)

Select S-Curve Mode with MODE key. Note that it is required to set Write Data No. A0 (Drive Type) to S-Curve Drive before selecting this mode.
The range within which acceleration and deceleration speeds vary is divided into three - SCSPD1, SCSPD2, and S-Curve Rate based on LSPD, HSPD, and RATE values programmed in Write Data entries. By default, these three values are automatically set in the basic S-curve parameters.
It is, therefore, not required to set these parameters unless they needs fine adjustments.

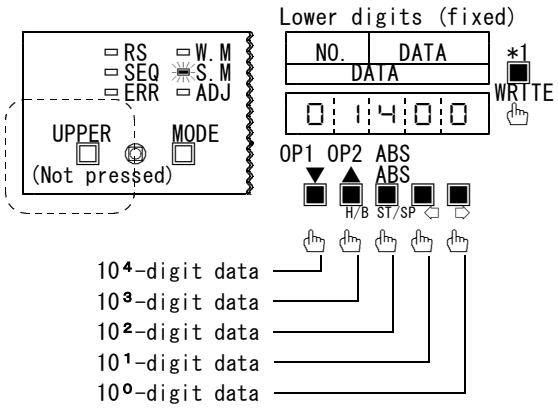


The following example shows a case where SCSPD1 for INDEX02 is set to 1400 Hz.

・When UPPER key is pressed:



・When UPPER key is released:



*1 When you press WRITE key, SCSPD data specified with S-Curve Data number is written. Approximately one second later, the S-Curve Data number is automatically incremented. Press WRITE key while holding down UPPER key only when entering all SCSPD data values in one step.

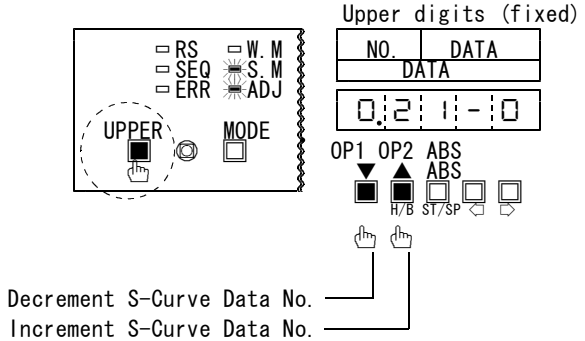
(9)Adjusting S-Curve Drive

Select C-Curve Adjust Mode (an S-Curve Mode) with MODE key. Note that it is required to set Write Data No. A0 (Drive Type) to S-Curve Drive before selecting this mode.

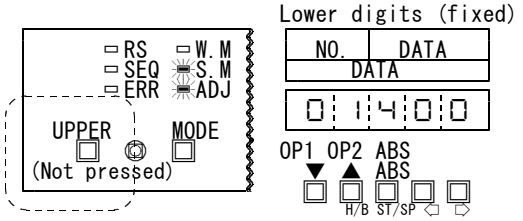
■Selecting the number corresponding to the INDEX to which S-Curve Drive is applied and verifying target address

The following example shows a case where SCSPD1 for INDEX02 is set to 1400 Hz and the target address +1269.

・When UPPER key is pressed:
Select the number assigned to the INDEX whose SCSPD setting needs adjustments.

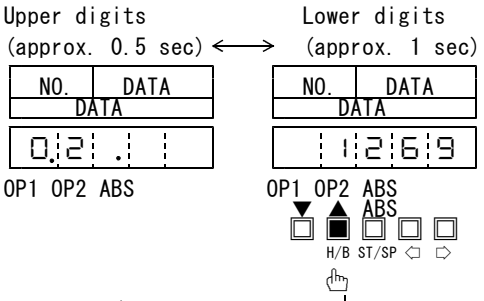


・When UPPER key is released:
The SCSPD currently stored in a memory appears.



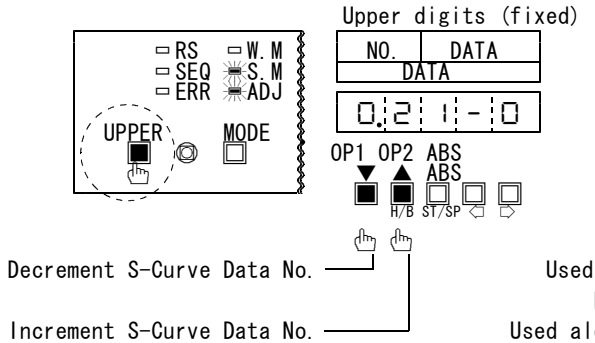
When H/B key is pressed alone, the target addressis displayed.

Auto Switching

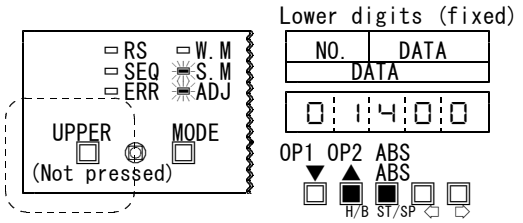


■Starting and stopping S-Curve Drive

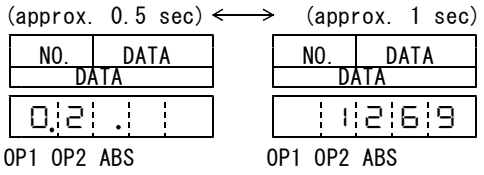
・When UPPER key is pressed:
Select the number assigned to the INDEX to which S-Curve Drive is applied.



・When UPPER key is released:
Start INDEX DRIVE in an S curve.



While INDEX DRIVE is active, the current value appears.



・ST (Start) key is enabled with UPPER key turned off, whereas SP (Stop) key operates irrespective of whether UPPER is turned on or off.

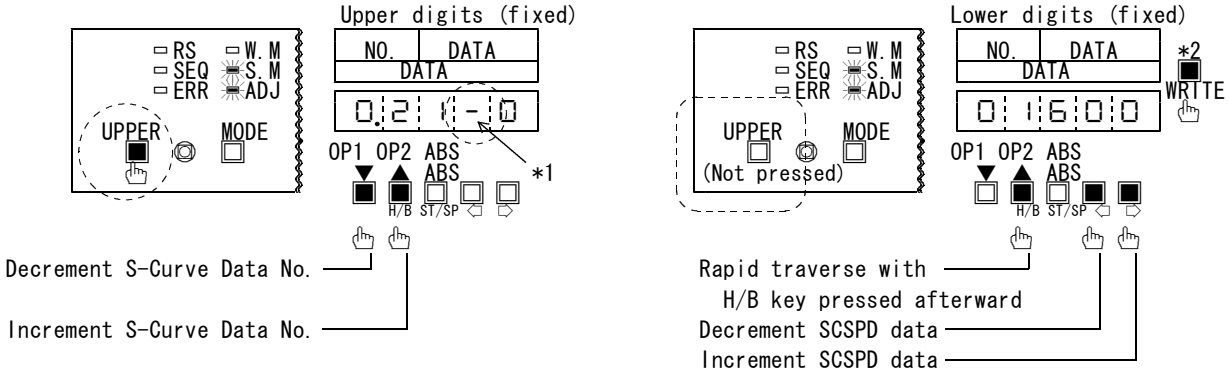
・Pressing H/B key and then ST/SP key returns the motor back to the position where it was started in an index movement. Verify the adjustments on the S-curve by repeating a drive that moves the motor to the target address and the one that returns it to it original position where it was in before an index movement was activated .

■Adjusting S-Curve Drive

The following example shows a case where SCSPD1 for INDEX02 initially set to 1400 Hz has been changed to 1600 Hz.

・When UPPER key is pressed:
Select the number assigned to the INDEX for which its S-curve is to be adjusted.

・When UPPER key is released:
Adjust SCSPD.



*1 This position displays a bar (-) within 100KHz.
For speeds in 1MHz, the display changes to indicate 10^6-digit SCSPD data.

*2 When you press WRITE key, SCSPD data is written to the S-Curve Data number specified. Approximately one second later, the S-Curve Data number is automatically incremented.

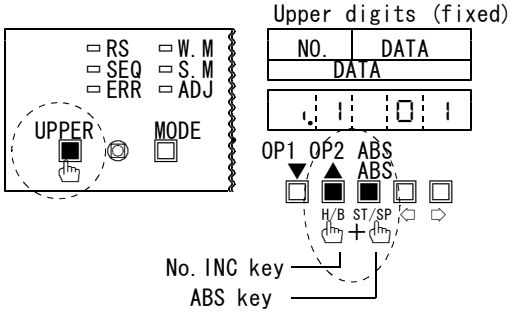
(10)Using Signal Check function

First, check that OP1 Mode is selected..

With Signal Check Mode on, the SEQ or RS RDY LED remains OFF, $\overline{RDY}$ = BUSY (High) output sent to a host sequencer.

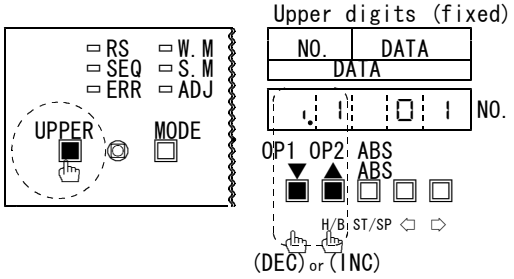
■Activating Signal Check Mode

Pressing both No. INC and ABS keys while holding down UPPER key activates the Signal Check Mode. The following example shows as case where the display changed to show the first IN signal in the Signal Check Mode.

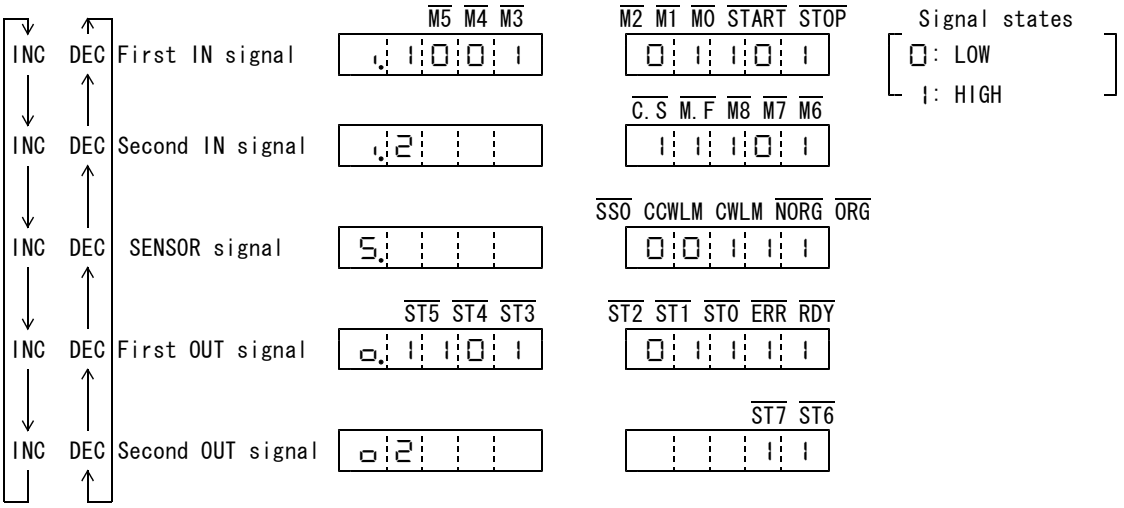


■Selecting and monitoring Signal Check Mode

Select the Signal Check Mode by pressing No. INC or DEC key while holding down UPPER key.

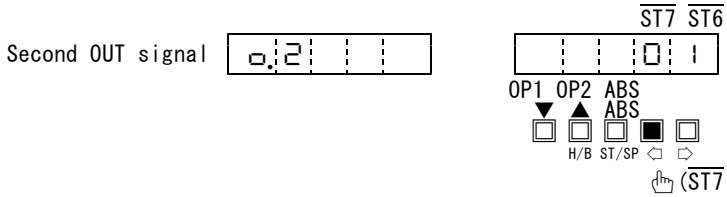


・When UPPER key is pressed: ・When UPPER key is released:



■Example of operating signals

To set $\overline{ST7}$:



■Clearing Signal Check Mode

Pressing MODE key clears the Signal Check Mode.

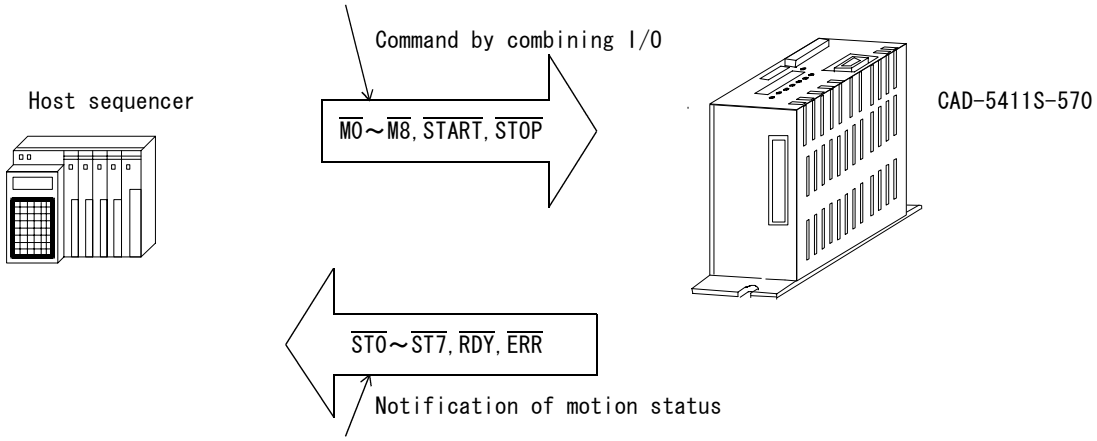
6. SEQUENCER CONTROL

6-1.Introduction of Sequencer Control

The sequencer control is a control mode depending on designation of Motion No. selected by $\overline{M}$ LINE signal from the host sequencer.
When the power supply is turned on or when $\overline{RESET}$ is input, the controller waits for commands from the sequencer and the SEQ LED on the main panel comes on.
The host sequencer sends out $\overline{START}$ signal while handshaking operation in each mode with $\overline{RDY}$ signal and STATUS ($\overline{ST}$) signal.
When an error occurs, CAD-5411S-570 informs the error by $\overline{ERR}$ signal, and interlock-like control is possible because $\overline{ERR}$ signal is regarded as the ladder conditions.

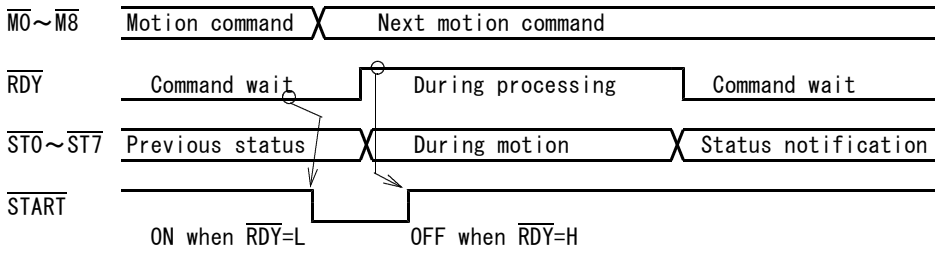
■Motion Selection and Status Grasping

Motion command	$\overline{M8}$	$\overline{M7}$	$\overline{M6}$	$\overline{M5}$	$\overline{M4}$	$\overline{M3}$	$\overline{M2}$	$\overline{M1}$	$\overline{M0}$
INDEX00 DRIVE	H	H	H	H	H	H	H	H	H/L
INDEX01 DRIVE	H	H	H	H	H	H	H	L	H/L
ORG DRIVE	H	H	L	L	L	H	L	L	–



Motion completion	$\overline{ST7}$	$\overline{ST6}$	$\overline{ST5}$	$\overline{ST4}$	$\overline{ST3}$	$\overline{ST2}$	$\overline{ST1}$	$\overline{ST0}$	$\overline{ERR}$	$\overline{RDY}$
INDEX00 DRIVE	H	H	H	H	H	H	H	H	H	L
INDEX01 DRIVE	H	H	H	H	H	H	H	L	H	L
ORG DRIVE		H	L	L	L	H	L	L	H	L

■Sequencer Handshaking Method



6-2.List of Motion Command and Status Signal

(1)External Mode Select Signal and Status Signal

When any mode other than the External Normal Mode is used, it is not necessary to designate the mode.

When $\overline{M0}$～$\overline{M8}$ signals are input, an External Mode can be changed over.

When an External Mode is selected, the status signal of the selected External Mode (Normal/Trace/Teaching, etc.) is output to the selected axis.

When in operation (not in the $\overline{RDY}$ status), External Mode cannot be changed over.

・When writing (setting)/ reading (storing) DATA from the sequencer I/O after changing over External Modes, refer to our technical information.

【External Mode Select Signal】

Status applicable No.	Motion	Motion command input signal									Display on panel
		$\overline{M8}$	$\overline{M7}$	$\overline{M6}$	$\overline{M5}$	$\overline{M4}$	$\overline{M3}$	$\overline{M2}$	$\overline{M1}$	$\overline{M0}$	
(1)	—	—	—	—	—	—	—	—	—	—	Motion No.
(2)	Setting inhibited	Ⓛ	H	H	H	H	H	H	H	*	E4
(3)	Setting inhibited	Ⓛ	H	H	H	H	H	H	Ⓛ	*	E4
(4)	Setting inhibited	Ⓛ	H	H	H	H	H	Ⓛ	H	*	E4
(5)	Setting inhibited	Ⓛ	Ⓛ	Ⓛ	H	Ⓛ	Ⓛ	Ⓛ	Ⓛ	*	E4
(6)	OP.MASK ON	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	H	H	*	bF
(7)	OP.MASK OFF	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	H	Ⓛ	*	bE
(8)	Setting inhibited	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	Ⓛ	H	*	E4
(9)	Setting inhibited	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	H	*	E4
(10)	S-Curve Data Reading Mode	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	Ⓛ	*	b6
(11)	Write Data Reading Mode	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	Ⓛ	H	*	b5
(12)	S-Curve Data Programming Mode	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	Ⓛ	Ⓛ	*	b4
(13)	Write Data Programming Mode	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	*	b3
(14)	TEACHING MODE	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	Ⓛ	*	b2
(15)	TRACE MODE	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	*	b1
(16)	NORMAL MODE	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	*	b0

・Input logic from EXTERNAL is Ⓛ=LOW ACTIVE when negative logic is input.

・$\overline{M0}$ marked with * is either H or Ⓛ.

【Status Signal】

Motion command applicable No.	Status output signal								Header status		Meaning of output signal
	$\overline{ST7}$	$\overline{ST6}$	$\overline{ST5}$	$\overline{ST4}$	$\overline{ST3}$	$\overline{ST2}$	$\overline{ST1}$	$\overline{ST0}$	$\overline{ERR}$	$\overline{RDY}$	
(1)	H	H	H	H	H	H	H	H	H	H	MODE is being set.
(2)	H	H	H	H	H	Ⓛ	H	H	Ⓛ	Ⓛ	An undefined input occurs.
(3)	H	H	H	H	H	Ⓛ	H	H	Ⓛ	Ⓛ	An undefined input occurs.
(4)	H	H	H	H	H	Ⓛ	H	H	Ⓛ	Ⓛ	An undefined input occurs.
(5)	H	H	H	H	H	Ⓛ	H	H	Ⓛ	Ⓛ	An undefined input occurs.
(6)	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	H	H	H	Ⓛ	OP. MASK is not ON any more.
(7)	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	H	Ⓛ	H	Ⓛ	OP. MASK is not OFF any more.
(8)	H	H	H	H	H	Ⓛ	H	H	Ⓛ	Ⓛ	An undefined input occurs.
(9)	H	H	H	H	H	Ⓛ	H	H	Ⓛ	Ⓛ	An undefined input occurs.
(10)	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	Ⓛ	H	Ⓛ	S-Curve Data Reading Mode is set.
(11)	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	Ⓛ	H	H	Ⓛ	Write Data Reading Mode is set.
(12)	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	Ⓛ	Ⓛ	H	Ⓛ	S-Curve Data Programming Mode is set.
(13)	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	H	Ⓛ	Write Data Programming Mode.
(14)	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	Ⓛ	H	Ⓛ	Teaching mode set.
(15)	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	Ⓛ	Trace mode set.
(16)	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	Ⓛ	Normal mode set.

・When an undefined input is available for Setting inhibited, E4 is displayed on the panel and an error status (Err 04H) is output.

・When the power supply is turned on or when $\overline{RESET}$ is input, the External Normal Mode is selected and the status 3FH is output.

(2) Motion Command in Normal Mode and Status Signal

This is a basic mode in which various drives such as INDEX, SCAN, etc. are selected from the sequencer and are operated.

Fundamental motion of operation can be performed in the combination to $\overline{M0}$～$\overline{M6}$.

【Motion Command Signal】

Status applicable No.	Motion	Motion command input signal									Display on panel	Running speed		Coordinate correction
		$\overline{M8}$	$\overline{M7}$	$\overline{M6}$	$\overline{M5}$	$\overline{M4}$	$\overline{M3}$	$\overline{M2}$	$\overline{M1}$	$\overline{M0}$		EXT	Teach	
(1)	—	—	—	—	—	—	—	—	—	—	Motion No			
(2)	INDEX00 DRIVE	H	H	H	H	H	H	H	H	H/Ⓛ	00	○	×	○
(3)	INDEX01 DRIVE	H	H	H	H	H	H	H	Ⓛ	H/Ⓛ	01	○	×	○
(4)	INDEX48 DRIVE	H	H	Ⓛ	Ⓛ	H	H	H	H	H/Ⓛ	48	○	×	○
(5)	INDEX49 DRIVE	H	H	Ⓛ	Ⓛ	H	H	H	Ⓛ	H/Ⓛ	49	○	×	○
(6)	($\overline{STOP}$ input:Deceleration)	—	—	—	—	—	—	—	—	—	P			
(7)	Setting inhibited	H	H	Ⓛ	Ⓛ	H	H	Ⓛ	H	*	E4			
(8)	Setting inhibited	H	H	Ⓛ	Ⓛ	H	Ⓛ	H	Ⓛ	*	E4			
(9)	INDEX50 DRIVE	H	H	Ⓛ	Ⓛ	H	Ⓛ	Ⓛ	H	H/Ⓛ	50	○	×	○
(10)	Setting inhibited	H	H	Ⓛ	Ⓛ	H	Ⓛ	Ⓛ	Ⓛ	*	E4			
(11)	M.CSCAN DRIVE	H	H	Ⓛ	Ⓛ	Ⓛ	H	H	H	H/Ⓛ	A6	○		
(12)	SENSOR DRIVE	H	H	Ⓛ	Ⓛ	Ⓛ	H	H	Ⓛ	H/Ⓛ	90	○	×	
(13)	RTN DRIVE	H	H	Ⓛ	Ⓛ	Ⓛ	H	Ⓛ	H	*	A0	○	×	
(14)	ORG DRIVE	H	H	Ⓛ	Ⓛ	Ⓛ	H	Ⓛ	Ⓛ	*	A1	○	×	
(15)	M.SCAN DRIVE	H	H	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	H	H/Ⓛ	A2	○		
(16)	R.P.SET	H	H	Ⓛ	Ⓛ	Ⓛ	Ⓛ	H	Ⓛ	*	A3			
(17)	Setting inhibited	H	H	Ⓛ	Ⓛ	H	Ⓛ	Ⓛ	Ⓛ	*	E4			
(18)	REST DRIVE	H	H	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	*	A5	○	×	○
(19)	(P.ON or $\overline{RESET}$ input)	—	—	—	—	—	—	—	—	—				
(20)	**Current Value Address Reading 1CODE**	H	Ⓛ	H	H	H	H	H	H	*	b0			
(21)	**Current Value Address Reading 2CODE**	H	Ⓛ	H	H	H	H	H	Ⓛ	*	b1			
(22)	**Current Value Address Reading 3CODE**	H	Ⓛ	H	H	H	H	Ⓛ	H	*	b2			
(23)	**Current Value Address Reading 4CODE**	H	Ⓛ	H	H	H	H	Ⓛ	Ⓛ	*	b3			
(24)	**INDEX50 Travel Setting 1CODE**	H	Ⓛ	H	H	H	Ⓛ	H	H	*	F0			
(25)	**INDEX50 Travel Data1**	H	**INDEX Type(0=INC,1=ABS+,2=ABS-)**				Travel 10^6							
(26)	**INDEX50 Travel Setting 2CODE**	H	Ⓛ	H	H	H	Ⓛ	H	Ⓛ	*	F1			
(27)	**INDEX50 Travel Data2**	H	Travel 10^5				Travel 10^4							
(28)	**INDEX50 Travel Setting 3CODE**	H	Ⓛ	H	H	H	Ⓛ	Ⓛ	H	*	F2			
(29)	**INDEX50 Travel Data3**	H	Travel 10^3				Travel 10^2							
(30)	**INDEX50 Travel Setting 4CODE**	H	Ⓛ	H	H	H	Ⓛ	Ⓛ	Ⓛ	*	F3			
(31)	**INDEX50 Travel Data4**	H	Travel 10^1				Travel 10^0							
(32)	**INDEX50 HSPD Setting 1CODE**	H	Ⓛ	H	H	Ⓛ	H	H	H	*	F4			
(33)	INDEX50 HSPD Data1	H	—				HSPD 10^6							
(34)	**INDEX50 HSPD Setting 2CODE**	H	Ⓛ	H	H	Ⓛ	H	H	Ⓛ	*	F5			
(35)	INDEX50 HSPD Data2	H	HSPD 10^5				HSPD 10^4							
(36)	**INDEX50 HSPD Setting 3CODE**	H	Ⓛ	H	H	Ⓛ	H	Ⓛ	H	*	F6			
(37)	INDEX50 HSPD Data3	H	HSPD 10^3				HSPD 10^2							
(38)	**INDEX50 HSPD Setting 4CODE**	H	Ⓛ	H	H	Ⓛ	H	Ⓛ	Ⓛ	*	F7			
(39)	INDEX50 HSPD Data4	H	HSPD 10^1				HSPD 10^0							
(40)	Setting inhibited	H	Ⓛ	H	H	Ⓛ	Ⓛ	H	H	*	E4			
(41)	Setting inhibited	H	Ⓛ	H	H	Ⓛ	Ⓛ	Ⓛ	H	*	E4			
(42)	Setting inhibited	H	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	Ⓛ	*	E4			

- At the times of Incremental Index, Scan Drive and Sensor Drive, the $\overline{M0}$ signal designate a direction; H=+(CW) direction or Ⓛ=-(CCW) direction. At the time of Absolute Index Drive and in case of motion command marked with *, either H or Ⓛ will do.
  When Index50 Data is transferred, it becomes the least significant bit of BCD Data.
- For reading of current value address, specify a place to be read by Code.
- For Index 50 travel and HSPD Data, set Code and Data (BCD) continuously at necessary places. Data not transferred by Index50 is not handled as 0 (zero) and becomes the previous data. For Index Type, BCD sets any of Incremental=0, Absolute+=1 and Absolute-=2.
- Index50 travel from Sequencer I/O and HSPD Transfer Data are retained until the power supply is turned on or $\overline{RESET}$ is input, and it is not necessary to transfer data each time unless data is changed. After the power supply is turned on or $\overline{RESET}$ is input, the data stored in the EEROM starts the sequencer.

【Status Output】 R2

Motion command applicable No.	Status output signal								Header status		Meaning of output signal
	$\overline{ST7}$	$\overline{ST6}$	$\overline{ST5}$	$\overline{ST4}$	$\overline{ST3}$	$\overline{ST2}$	$\overline{ST1}$	$\overline{ST0}$	$\overline{ERR}$	$\overline{RDY}$	
(1)	H	H	H	H	H	H	H	H	H	H	During motion
(2)	H	H	H	H	H	H	H	H	H	L	INDEX00 Drive Completion
(3)	H	H	H	H	H	H	H	L	H	L	INDEX01 Drive Completion
(4)	H	H	L	L	H	H	H	H	H	L	INDEX48 Drive Completion
(5)	H	H	L	L	H	H	H	L	H	L	INDEX49 Drive Completion
(6)	H	H	L	L	H	H	L	H	H	L	At a halt
(7)	H	H	H	H	H	L	H	H	L	L	Undefined input occurrence
(8)	H	H	H	H	H	L	H	H	L	L	Undefined input occurrence
(9)	H	H	L	L	H	L	L	H	H	L	INDEX50 Drive Completion
(10)	H	H	H	H	H	L	H	H	L	L	Undefined input occurrence
(11)	H	H	L	L	L	H	H	H	H	L	M.CSCAN Drive Completion
(12)	H	H	L	L	L	H	H	L	H	L	SENSOR Drive Completion
(13)	H	H	L	L	L	H	L	H	H	L	RTN Drive Completion
(14)	H	H	L	L	L	H	L	L	H	L	ORG Drive Completion
(15)	H	H	L	L	L	L	H	H	H	L	M.SCAN Drive Completion
(16)	H	H	L	L	L	L	H	L	H	L	R.P.SET Completion
(17)	H	H	H	H	H	L	H	H	L	L	Undefined input occurrence
(18)	H	H	*	*	*	*	*	*	H	L	Halt Motion Completion Status Output
(19)	H	H	L	L	L	L	L	L	H	L	Initial status
(20)	Code (1=+ABS,2=-ABS)				10^6 digits				H	L	**Current Value Address Reading Data1 Notification**
(21)	10^5 digits				10^4 digits				H	L	**Current Value Address Reading Data2 Notification**
(22)	10^3 digits				10^2 digits				H	L	**Current Value Address Reading Data3 Notification**
(23)	10^1 digits				10^0 digits				H	L	**Current Value Address Reading Data4 Notification**
(24)	H	L	H	H	H	L	H	H	H	L	INDEX50 Travel Setting 1CODE Completion
(25)	**Index Type Set Value**				**INDEX50 Travel 10^6 Set Value**				H	L	**INDEX50 Travel Setting 1Data Notification**
(26)	H	L	H	H	H	L	H	L	H	L	INDEX50 Travel Setting 2CODE Completion
(27)	**INDEX50 Travel 10^5 Set Value**				**INDEX50 Travel 10^4 Set Value**				H	L	**INDEX50 Travel Setting 2Data Notification**
(28)	H	L	H	H	H	L	L	H	H	L	INDEX50 Travel Setting 3CODE Completion
(29)	**INDEX50 Travel 10^3 Set Value**				**INDEX50 Travel 10^2 Set Value**				H	L	**INDEX50 Travel Setting 3Data Notification**
(30)	H	L	H	H	H	L	L	L	H	L	INDEX50 Travel Setting 4CODE Completion
(31)	**INDEX50 Travel 10^1 Set Value**				**INDEX50 Travel 10^0 Set Value**				H	L	**INDEX50 Travel Setting 4Data Notification**
(32)	H	L	H	H	L	H	H	H	H	L	INDEX50 HSPD Setting 1CODE Completion
(33)	—				INDEX50 HSPD 10^6 Set Value				H	L	INDEX50 HSPD Setting 1Data Notification
(34)	H	L	H	H	L	H	H	L	H	L	INDEX50 HSPD Setting 2CODE Completion
(35)	INDEX50 HSPD 10^5 Set Value				INDEX50 HSPD 10^4 Set Value				H	L	INDEX50 HSPD Setting 2Data Notification
(36)	H	L	H	H	L	H	L	H	H	L	INDEX50 HSPD Setting 3CODE Completion
(37)	INDEX50 HSPD 10^3 Set Value				INDEX50 HSPD 10^2 Set Value				H	L	INDEX50 HSPD Setting 3Data Notification
(38)	H	L	H	H	L	H	L	L	H	L	INDEX50 HSPD Setting 4CODE Completion
(39)	INDEX50 HSPD 10^1 Set Value				INDEX50 HSPD 10^0 Set Value				H	L	INDEX50 HSPD Setting 4Data Notification
(40)	H	H	H	H	H	L	H	H	L	L	Undefined input occurrence
(41)	H	L	H	H	L	L	L	H	H	L	Immediate Stop
(42)	H	H	H	H	H	L	H	H	L	L	Undefined input occurrence

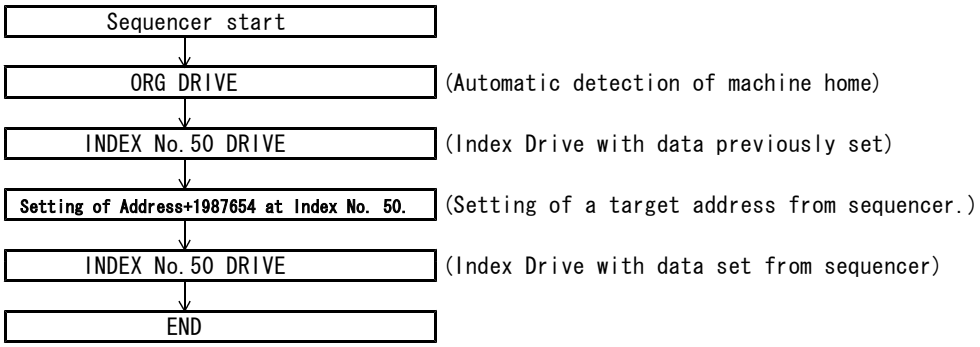
- When a Current Value Address Reading is instructed, CAD-5411S-570 outputs BCD Data of the Current Value Address in any unit of pulse, mm and angle set by Write Data No. A6 to the status line.
- When the $\overline{Stop}$ signal set with the Stop Type of Write Data No. A4 stops the sequencer, any of the following statuses is output:
  Stop Type 0 : Stop after deceleration, No ERR output, Status 32H, A REST DRIVE is possible.
  Stop Type 1 : Immediate stop, ERR is output. Status 02H, No REST DRIVE is possible.
  Stop Type 2 : Immediate stop, No ERR output. Status 4EH, No REST DRIVE is possible.
- When an setting inhibited undefined input is available, E4 is displayed on the panel and an error status (Err 04H) is output.

6-3.Motion Example

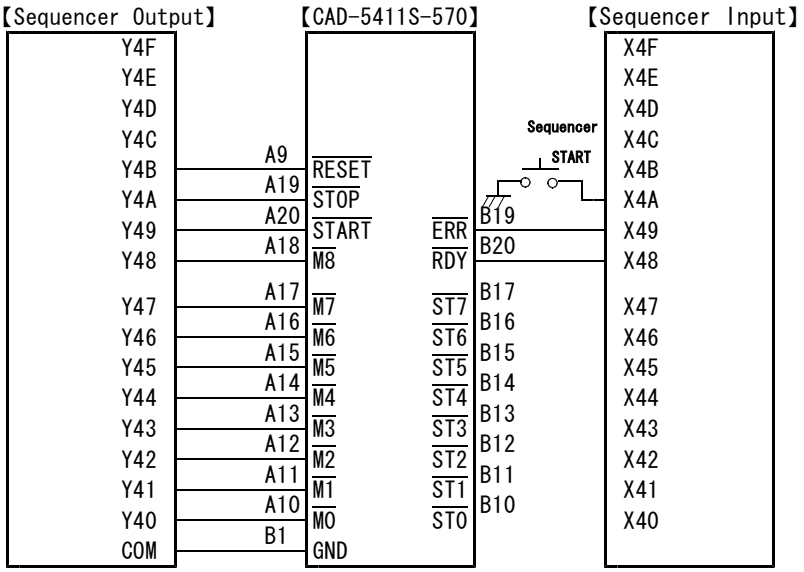
R2

Index No. 50 is used to execute an Index Drive with most basic data previously set.
Then, the Data Transfer function from Index50 Sequencer is used for positioning with a target address data transfer from the sequencer.

(1)Motion Flow


Sequencer start
ORG DRIVE
(Automatic detection of machine home)
INDEX No.50 DRIVE
(Index Drive with data previously set)
Setting of Address+1987654 at Index No. 50.
(Setting of a target address from sequencer.)
INDEX No.50 DRIVE
(Index Drive with data set from sequencer)
END

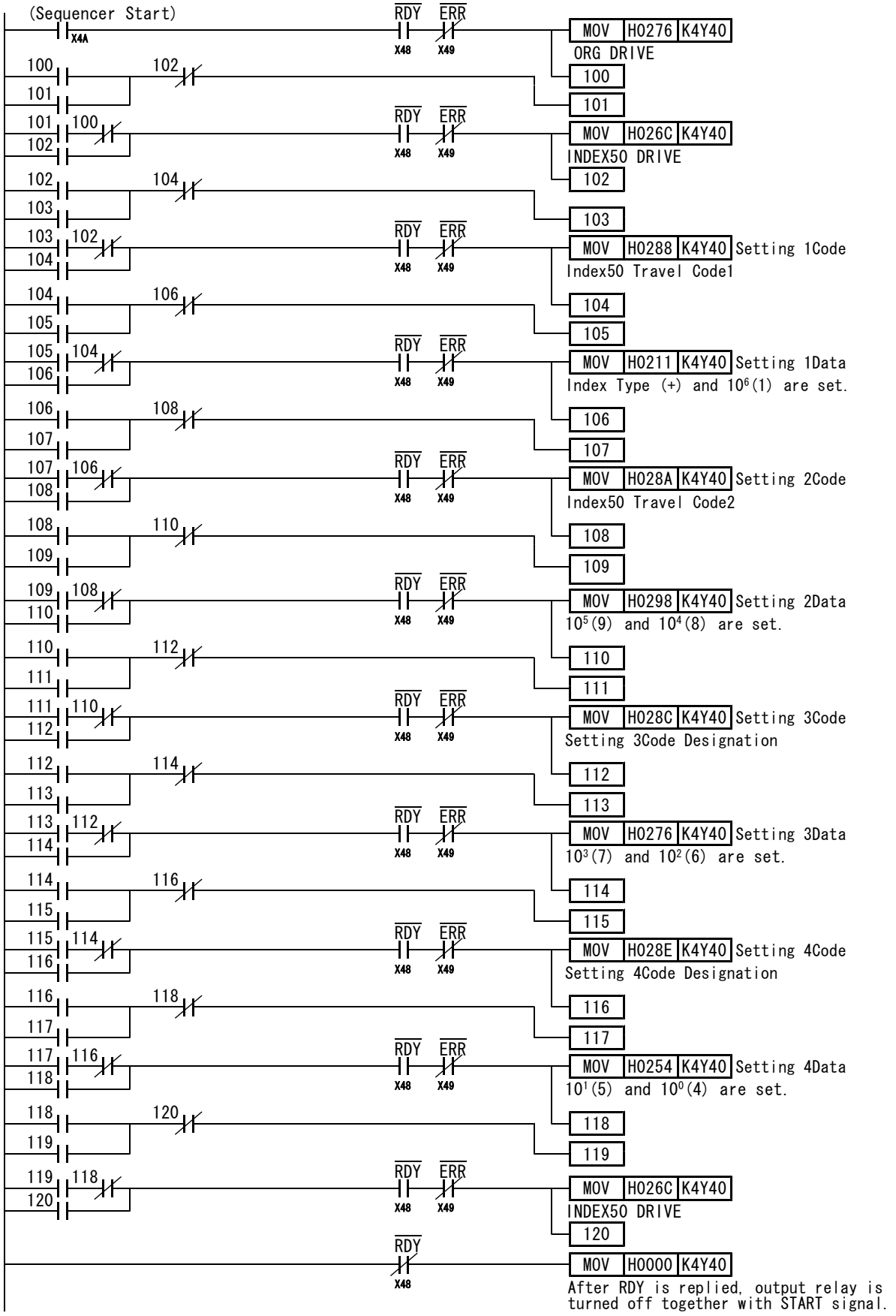
(2)Connection



(3)Allocated Signal Table

Example of Sequencer Data Memory Setup Allocation / Motion command	High order←				K4Y040											→Low order	Data in data memory
	⑧	④	②	①	⑧	④	②	①	⑧	④	②	①	⑧	④	②	①	
	Y4F	Y4E	Y4D	Y4C	Y4B	Y4A	Y49	Y48	Y47	Y46	Y45	Y44	Y43	Y42	Y41	Y40	
					RESET	STOP	START	M8	M7	M6	M5	M4	M3	M2	M1	M0	
INDEX50 Travel Setting 1CODE	H	H	H	H	H	H	L	H	L	H	H	H	L	H	H	H	02_88
INDEX Type , INDEX10^{6}	H	H	H	H	H	H	L	H	H	H	H	L	H	H	H	L	02_11
INDEX50 Travel Setting 2CODE	H	H	H	H	H	H	L	H	L	H	H	H	L	H	L	H	02_8A
INDEX10^{5} , INDEX10^{4}	H	H	H	H	H	H	L	H	L	H	H	L	L	H	H	H	02_98
INDEX50 Travel Setting 3CODE	H	H	H	H	H	H	L	H	L	H	H	H	L	L	H	H	02_8C
INDEX10^{3} , INDEX10^{2}	H	H	H	H	H	H	L	H	H	L	L	L	H	L	L	H	02_76
INDEX50 Travel Setting 4CODE	H	H	H	H	H	H	L	H	L	H	H	H	L	L	L	H	02_8E
INDEX10^{1} , INDEX10^{0}	H	H	H	H	H	H	L	H	H	L	H	L	H	L	H	H	02_54
ORG DRIVE	H	H	H	H	H	H	L	H	H	L	L	L	H	L	L	H	02_76
INDEX50 DRIVE	H	H	H	H	H	H	L	H	H	L	L	H	L	L	H	H	02_6C

(4) Example of Ladder Circuit R2



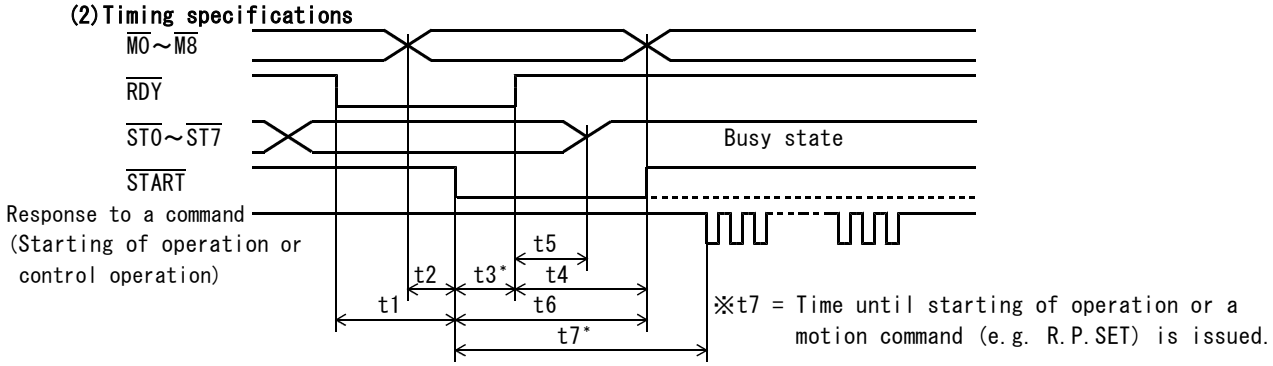
6-4.List of Timings for External Operations

(1)How to issue $\overline{\text{START}}$ signal

Determine that the $\overline{\text{RDY}}$ signal is set (Low) before specifying motor movements with $\overline{\text{M0}}$ through $\overline{\text{M8}}$. Then, issue a $\overline{\text{START}}$ to activate the specified motion.

- Always ensure that $\overline{\text{RDY}}$ is active (CAD-5411S-570 waits for a command) before issuing a $\overline{\text{START}}$.
- Always ensure that $\overline{\text{RDY}}$ is inactive (CAD-5411S-570 responded to a command) before resetting a $\overline{\text{START}}$.
- $\overline{\text{RDY}}$ will not become active if $\overline{\text{START}}$ is left active when the CAD-5411S-570 completed motor motions.

(2)Timing specifications

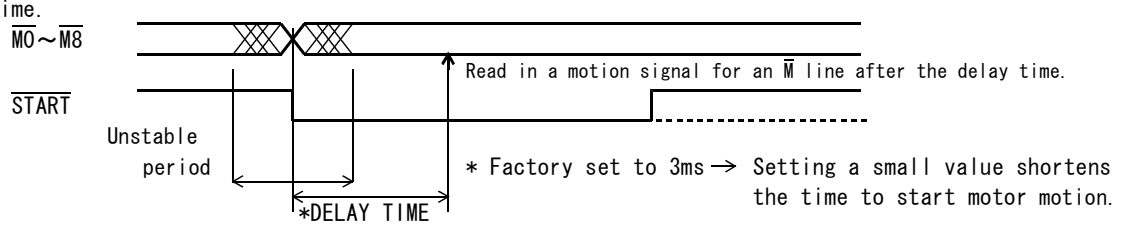


An asterisk (*) in the following table indicates the value when Delay Time for the CAD-5411S-570 to read in a $\overline{\text{START}}$ set to 0.1ms.

Command	t1	t2	t3	t4	t5	t6	t7	Description of t7
INDEX DRIVE (Trapezoidal Drive)	≧0	≧0	≦0.6ms*	≧0	>0	Until $\overline{\text{RDY}}$ = High	≦1.1ms*	Until starting of a motor
INDEX DRIVE (S-Curve	≧0	≧0	≦0.6ms*	≧0	>0	Until $\overline{\text{RDY}}$ = High	≦1.6ms*	Until starting of a motor
RTN DRIVE	≧0	≧0	≦0.6ms*	≧0	>0	Until $\overline{\text{RDY}}$ = High	≦1.1ms*	Until starting of a motor
SENSOR DRIVE	≧0	≧0	≦0.6ms*	≧0	>0	Until $\overline{\text{RDY}}$ = High	≦1.1ms*	Until starting of a motor
M.SCAN DRIVE	≧0	≧0	≦0.6ms*	≧0	>0	Until $\overline{\text{RDY}}$ = High	≦12.1ms*	Until starting of a motor
M.CSCAN DRIVE	≧0	≧0	≦0.6ms*	≧0	>0	Until $\overline{\text{RDY}}$ = High	≦12.1ms*	Until starting of a motor
ORG DRIVE	≧0	≧0	≦0.6ms*	≧0	>0	Until $\overline{\text{RDY}}$ = High	≦1.1ms*	Until starting of a motor
REST DRIVE	≧0	≧0	≦0.6ms*	≧0	>0	Until $\overline{\text{RDY}}$ = High	≦1.1ms*	Until starting of a motor
R.P.SET	≧0	≧0	≦0.6ms*	≧0	>0	Until $\overline{\text{RDY}}$ = High	≦1.1ms*	Until SET completed
Set INDEX50 Data	≧0	≧0	≦0.6ms*	≧0	>0	Until $\overline{\text{RDY}}$ = High	≦1.1ms*	Until code and data entries are responded
Read Address Data	≧0	≧0	≦0.6ms*	≧0	>0	Until $\overline{\text{RDY}}$ = High	≦1.1ms* (≦10ms)	Until data is rea dy on status line

(3)Delay time for $\overline{\text{START}}$ signal

Simultaneous activation of the $\overline{\text{M}}$ signal lines and $\overline{\text{START}}$ signal on sequencer ladder logic may not be synchronized with those signals from an output device. On the controller, the delay time for $\overline{\text{START}}$ is factory set to 3ms to ensure that a motion signal is read in when a $\overline{\text{START}}$ is issued. To shorten the time until pulses are output or to start motor motion, set a small value for the delay time.

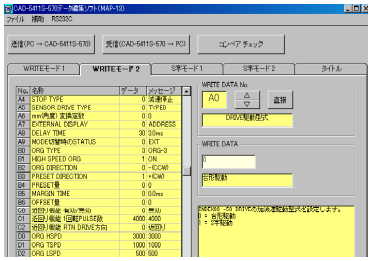

M0～M8
START
Read in a motion signal for an M line after the delay time.
Unstable
period
*DELAY TIME
* Factory set to 3ms → Setting a small value shortens
the time to start motor motion.

7. RS CONTROL

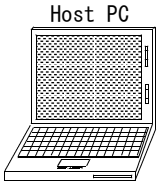
7-1.Outline of RS Control

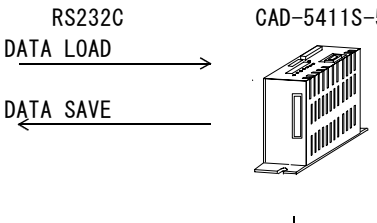
RS Control is a mode in which data is transferred (sent or received) between the CAD-5411S-570 and a personal computer via RS232C communications. It allows the sending (loading) of CAD-5411S-570 data from a PC and the receiving (saving) CAD-5411S-570 internal data by the PC.
When the control is passed to RS Control via a command from a PC, the RS LED is lit to indicate that the controller is in that mode, $\overline{RDY}$ being set to High (Busy) to notify a host sequencer of this state. When the control is passed to a sequencer, the SEQ LED is lit to indicate that the controller is back in the wait for sequencer command state, $\overline{RDY}$ being set to Low (Ready) to notify a host sequencer of this state.

(Excerpt from MAP-13-SWXP Specifications)



Create data on PC and save data in it
Send created data (write to CAD-5411S-570)
Receive data (read from CAD-5411S-570)





Send RDY (High) to a host sequencer in RS Mode communicating PC.

7-2.Communication Specifications

■Base standard ----- RS232C (EIA-574 compliant)
■Communication mode ----- Half-duplex (full-duplex on the lines)
■Synchronization mode ----- Asynchronous
■Baud rates ----- 9.6Kbps/19.2Kbps/38.4Kbps/57.6Kbps (factory setting: 57.6 kbps)
■DATA bit ----- 7bit
■Parity check ----- Odd
■STOP bit ----- 1bit
■Terminate code ----- CR+LF

7-3.MAP-13-SWXP Specifications

(1)Details of screen

1Menus
・File menu: Provides file functions such as read, save, print and to quit the program.
・Auxiliary Menu: Provides an auxiliary function to set speed data in one step.
・RS232C Parameter Configuration Menu: Sets the baud rate for the RS232C.
(Both CAD-5411S-570 and MAP-13-SWXP are initially set to 57.6 kbps.)

2RS232C Send(Write)/Receive(Read)/Compare Check buttons
Select the data operation executed between the CAD-5411S-570 and PC.
The data sent to the CAD-5411S-570 via these buttons is backed up onto an EEROM in the CAD-5411S-570.

3Mode Selection tags
Select the modes of data to be programmed in the CAD-5411S-570.
・Write Mode 1: Sets distances for INDEX00 through INDEX50 and SENSOR DRIVE, and HSPD values.
・Write Mode 2: Sets system data for the CAD-5411S-570.
＊・S-Curve Mode 1: Sets SCSPD1 and SCSPD2 for INDEX00 through INDEX50 in the S-Curve Drive Mode.
＊・S-Curve Mode 2: Sets parameters required for S-Curve Drive.
・Title: Enter a title to manage the data you programmed.
＊ :You can program data only when S-Curve Drive has been selected with Write Data No.

4Data entry list pane
Displays a list of data entries based on the mode selected with the relevant mode selection tag.

5Data entry area
Used to enter (or alter) data.

6Message area
Displays messages that outline each of the data entries.

(2)Operating environment

Operating systems supported
・Microsoft Windows95
・Microsoft Windows98
・Microsoft WindowsME
・Microsoft WindowsNT4.0
・Microsoft Windows2000
・Microsoft WindowsXP

＊ Microsoft Windows is a registered trademark or trademark of Microsoft Corporation in the United States.

(3)Operating instructions

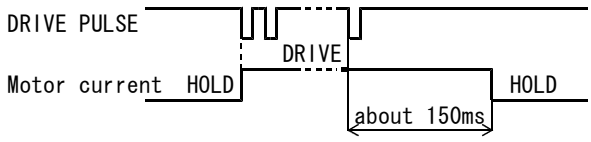
After installing the MAP-13-SWXP, refer to "MAP-13-SWXP User Help."
Following the instructions provided in Help, perform data creation, transmission, reception, and comparison.

8. MISCELLANEOUS SPECIFICATIONS

8-1.Automatic switching for DRIVE/HOLD

Starting of a drive causes current output to the motor to change from HOLD current to DRIVE current, which returns to HOLD current in about 150ms.

■DRIVE/HOLD current change timing



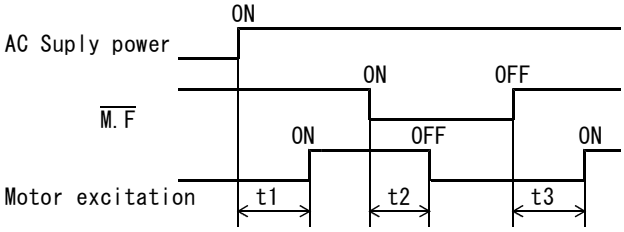
8-2.Motor excitation stop input (M.F)

> ⚠ Caution
> Deterioration of the holding power with the motor may cause breakage of machine or injury.
> Check safety before inputting.

Motor output current is shut off with the M.F signal on.
At this time, motor torque changes to detent torque.

- When this signal is input, motor torque may be lost, resulting in failure to return the load transported.
  In particular, this risk is high with the vertical drive(such as the Z-axis).

■Motor excitation stop input timing



t1 ≦ 1.5s (t1: Time required for the motor to be enabled.)
t2 ≦ 5ms (t2: Time required for the motor output current to be shut off.)
t3 ≦ 100ms (t3: Time required for the motor to be enabled.)

8-3.STEP angle switch input (C.S)

STEP angle division is switched to 1/20 divisions with the C.S signal on.
The setting for the STEP ANGLE SELECT switch is ignored.

- No displacement occurs even if the STEP angle is switched by the C.S signal.

■STEP ANGLE SELECT switch and C.S signal

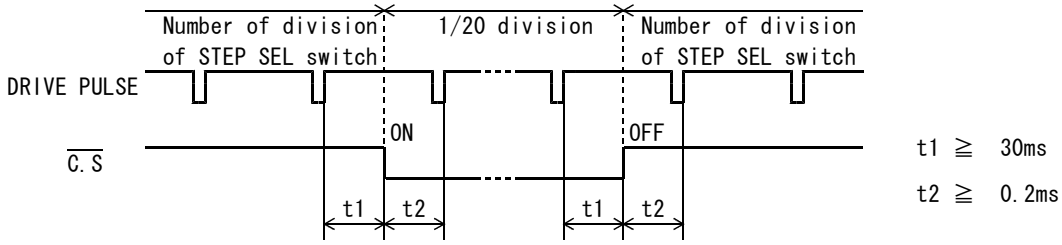
〔STEP ANGLE SELECT switch〕

switch No.	Number of Divisions	STEP angle(°)	
		0.72° motor	0.36° motor
0	1/1	0.72	0.36
1	1/2	0.36	0.18
2	1/4	0.18	0.09
3	1/8	0.09	0.045
4	1/10	0.072	0.036
5	1/16	0.045	0.0225
6	1/20	0.036	0.018
7	1/40	0.018	0.009
8	1/80	0.009	0.0045
9	1/160	0.0045	0.00225

[When the C.S signal is input]

1/20 divisions
(0.036° or 0.018°)

■STEP ANGLE SELECT switch input timing



・Switching the STEP angle by the C.S signal requires time t1 and t2 before and after starting of a drive.

8-4.Overheat alarm (O.H.A)signal output

⚠ WARNING

Overheating may cause fire.
Stop operation upon output of this signal.

In case of internal temperature reaches about 65℃ or higher, a signal is output (the temperature sensor contact).
Motor output current is not intercepted at this time.

・When this signal is output, stop operation and check if there is any abnormality occurring with the motor and the CAD-5411S-570.
・Provide mechanical cooling, for example, if this signal is output while no abnormality is detected.

8-5.Specail Functions for driver

⚠ Caution

Erroneous setting may cause breakage of the machine or injury due to unexpected rotation of the motor.
Do not use usually.
Contact us if you use this functions.

(1) Function to change step motion

You can choose between AD Step Motion and MD Step Motion.

(2) Function to change motor vibratoin

You can choose character of the motor vibration on accelerating/decelerating drive.

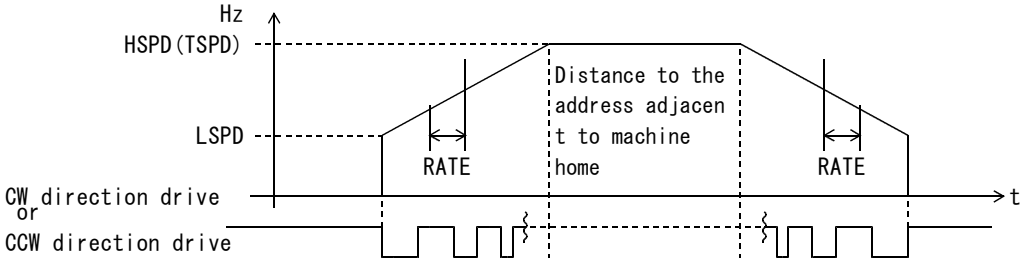
●We are preparing a technical data titled "Details of Special Function Switch.
Contact us if you are interested.

8-6.ORG DRIVE (machine home detection)

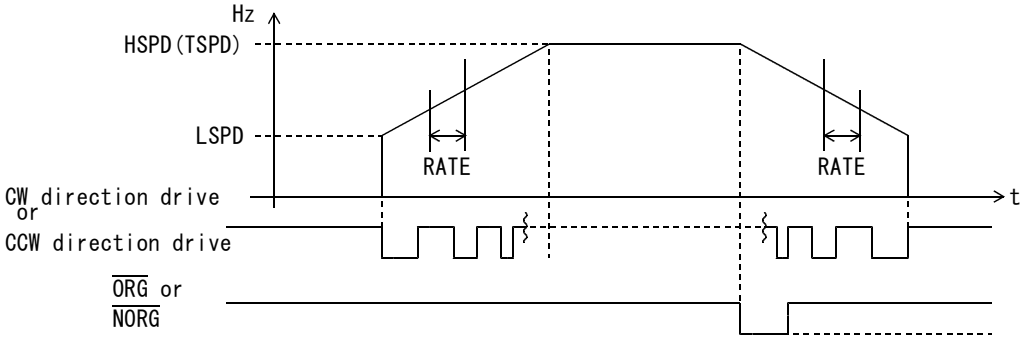
(1)Description of ORG DRIVE

The ORG DRIVE automatically moves the motor according to the preset data until the machine home is found. Upon completion of ORG DRIVE, the current motor position is automatically set as electrical zero(absolute address 0). A combination of 1, 2, 3, 4 and 5 shown below forms the drive pattern.

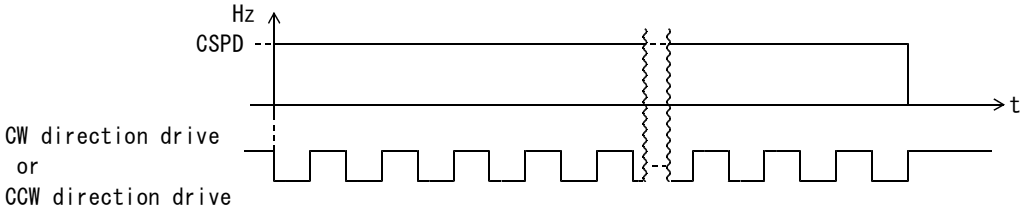
1 Accel/Decel Drive cycle (a process to accelerate or decelerate the motor as far as the address adjacent to machine home (= machine home + offset)



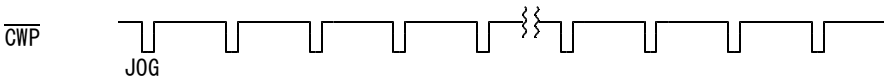
2 Accel/Decel Drive cycle (a process continued until the ORG sensor is detected at HSPD



3 Constant Speed Drive cycle (a process to detect the ORG sensor at a constant speed)



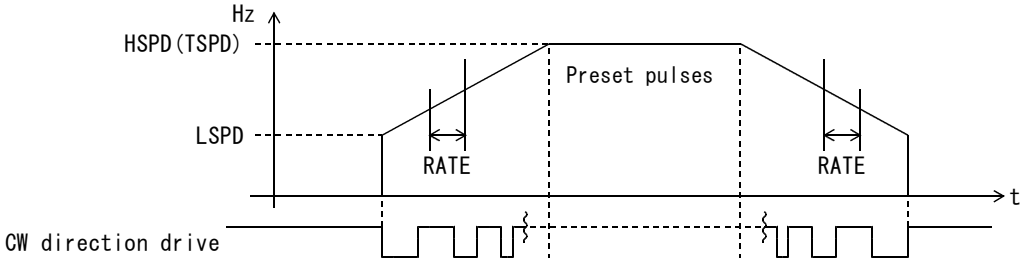
4 Precision Drive cycle (a process to detect the edge of ORG sensor with JOG DRIVE)



・None of ORG-0, ORG-1, ORG-10, and ORG-11 involves an edge detection process.

5 Preset Drive cycle

Automatically positions the motor to the number of preset pulses in the preset direction after the machine home is detected.



・Stable home detection operation can be achieved by appropriately adjusting the position for home position (ORG) in the last process of the ORG detection cycle to avoid the extent to which a mechanical hunting occurs.

・When specifying another electrical zero after ORG detection,programming preset pulses eliminates the need for automatically running the motor with PRESET DRIVE to that electrical zero and issuing an R.P. SET.

(2)Types of machine home detection

ORG TYPE	No. of sensors required.	Sensor state when detection completes	Time required	Accuracy	Availability of backlash compensation	Requirements for position that starts activation	Features
ORG-0,11	One ORG(LIMIT)	OFF	Short	Low	Available	None	Fast detection
ORG-1	One ORG	ON	Short	Low	Available	None	Fast detection
ORG-2,12	One ORG(LIMIT)	OFF	Long	Medium	Available	None	Precise positioning with one sensor
ORG-3	One ORG	ON	Long	Medium	Available	None	Precise positioning with one sensor
ORG-4	Two ORG,NORG	OFF	Longest	High	Available	None	Pursuit of precision
ORG-5	Two ORG,NORG	ON	Longest	High	Available	None	Pursuit of precision
ORG-10	Two ORG,NORG	ON	Shortest	Low	Not available	None	Fastest detection

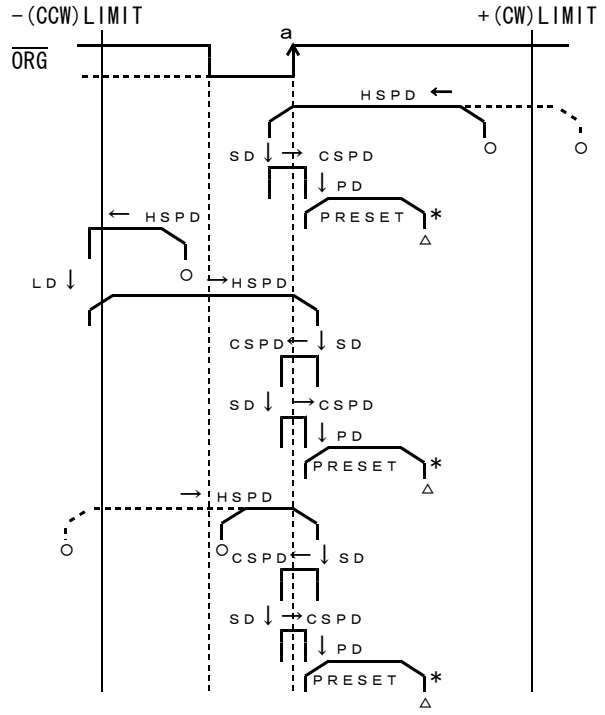
- ORG-11 and ORG-12 are types that use a LIMIT sensor input signal as an ORG signal.
- The sensor state when detection completes listed above indicates a condition with the number of preset pulses set to 0.
- Each of ORG-0 and ORG-1, ORG-2 and ORG-3, and ORG-4 and ORG-5 have the same motion cycle but differs in the sensor state when detection completes (ON or OFF).

(3)Explanation of symbols used for machine home detection process

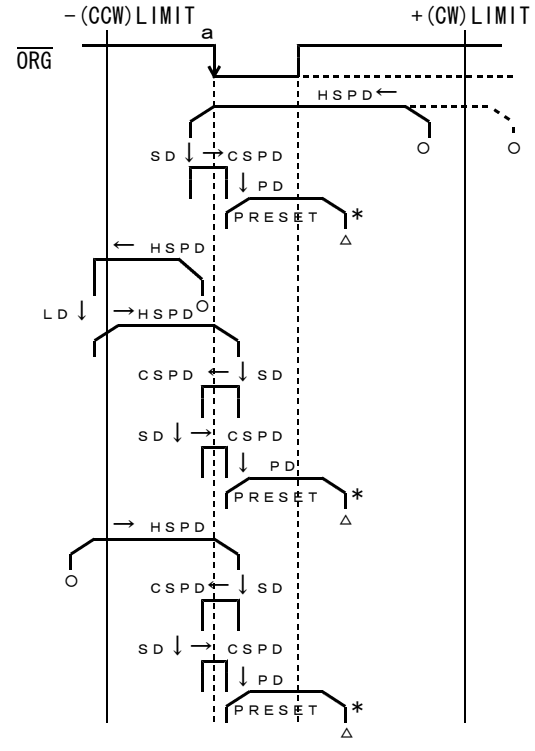
$\overline{ORG}$, $\overline{NORG}$ --------- Sensor signals (Sensor On = Low)
○ -------- Indicates the position to start detecting the machine home.
△ -------- Indicates the position to end the detection of the machine home.
⇒ ------- Indicates ACCEL/DECEL ORG DRIVE cycle and its direction (ORG HSPD)
PRESET ---- Indicates that the motor is automatically run with PRESET DRIVE after the detection of machine home. (When PRESET DRIVE added.)
⇒ -------- Indicates ORG CONSTANT SPEED DRIVE cycle and its direction (ORG CSPD)
⇒ -------- Indicates REPEAT JOG DRIVE cycle (20ms intervals) and its direction.
LD ---------- Indicates that a move is stopped by limit for 300ms. (LIMIT DELAY TIME)
SD ---------- Indicates that a move is stopped for 50ms at the start of SCAN DRIVE.(SCAN DELAY TIME)
JD ---------- Indicates that a move is stopped for 20ms at the start of JOG DRIVE. (JOG DELAY TIME)
PD ---------- Indicates that a move is stopped for 50ms at the start of PRESET DRIVE.(PRESET DELAY TIME)
＊ ---------- PRESET DRIVE added.

(4)Process charts by machine home detection type

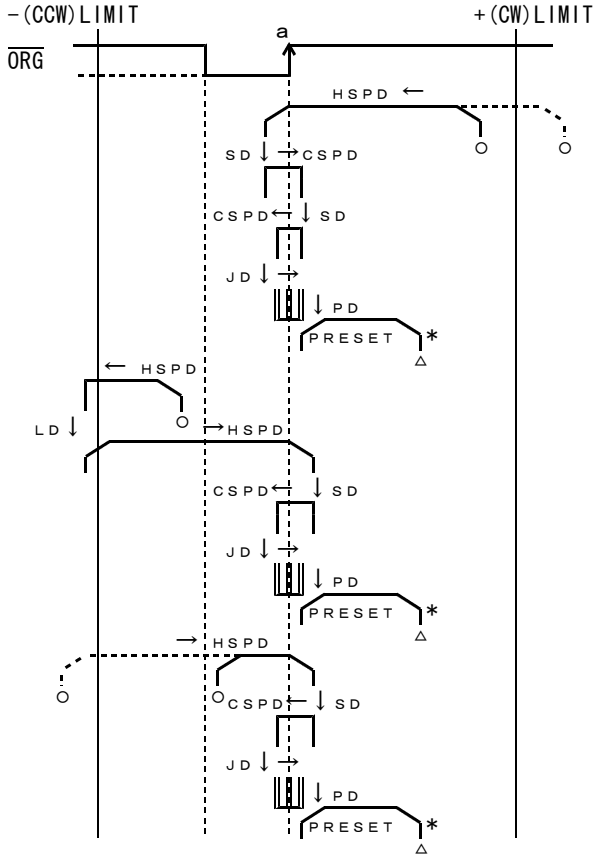
■ORG-0



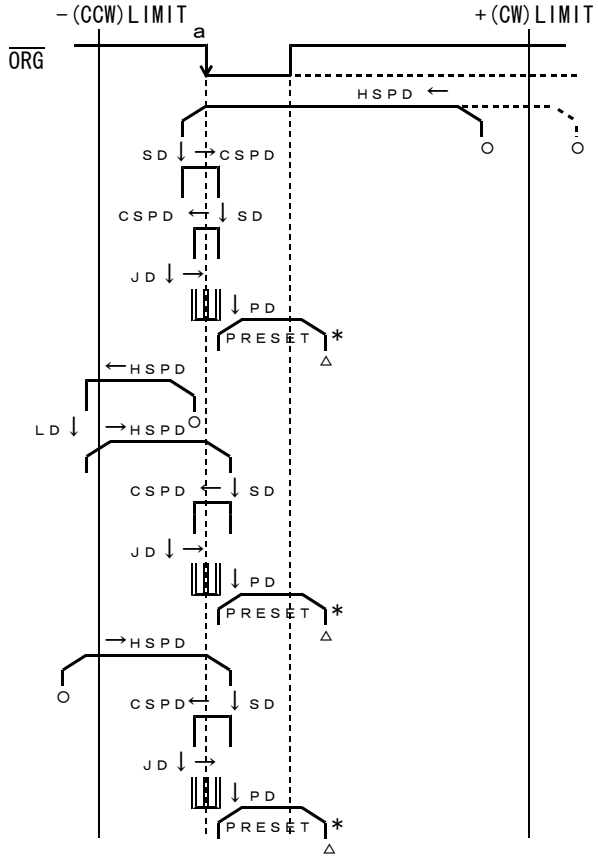
■ORG-1



■ORG-2

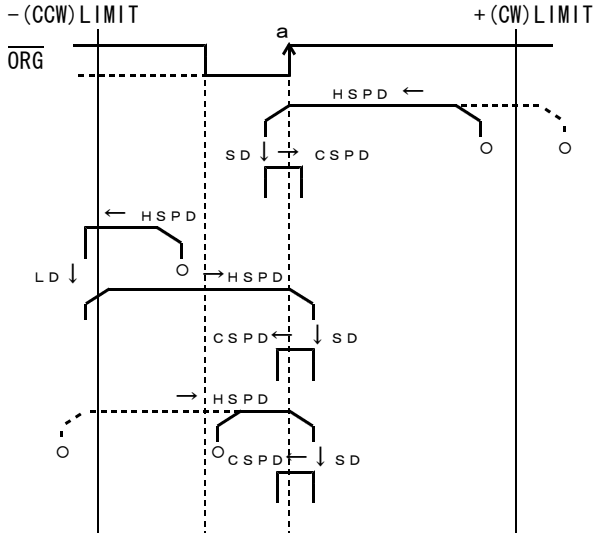


■ORG-3



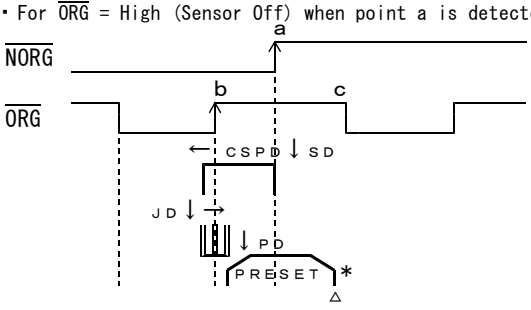
■ORG-4

【NEAR ORG process】

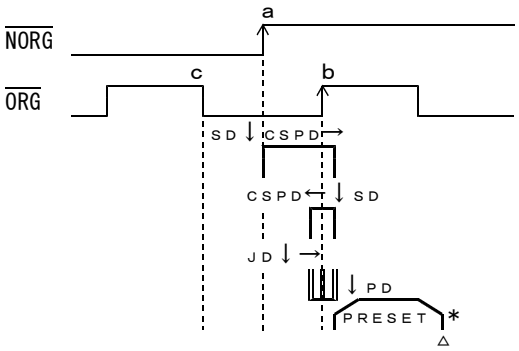


【ORG process】

・For $\overline{\text{ORG}}$ = High (Sensor Off) when point a is detected

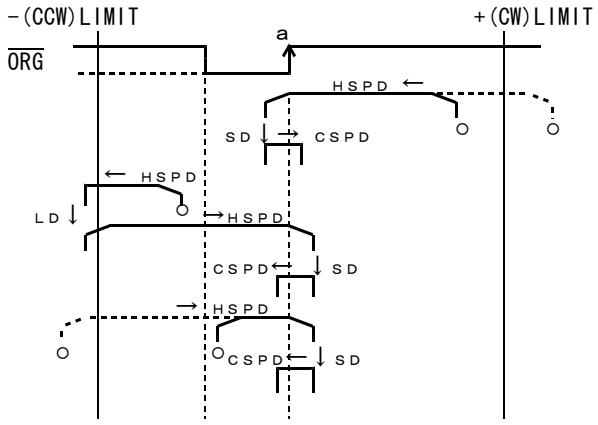


・For $\overline{\text{ORG}}$ = Low (Sensor On) when point a is detected



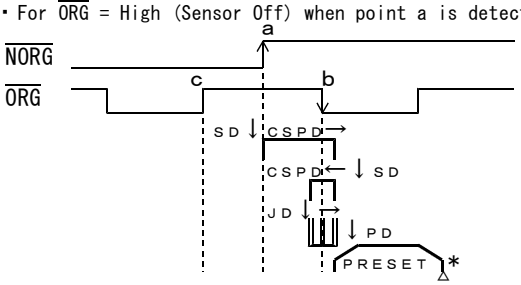
■ORG-5

【NEAR ORG process】

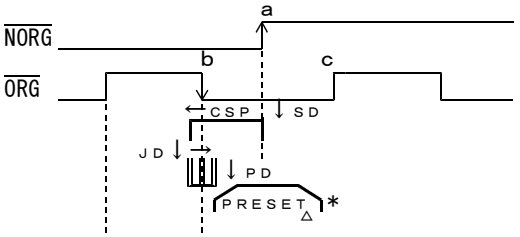


【ORG process】

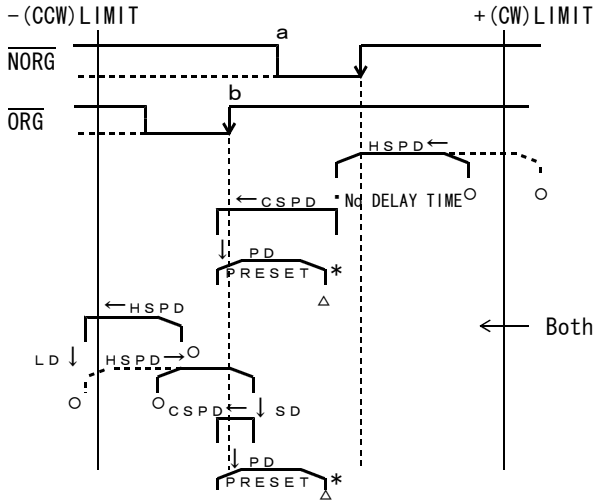
・For $\overline{ORG}$ = High (Sensor Off) when point a is detected



・For $\overline{ORG}$ = Low (Sensor On) when point a is detected



■ORG-10

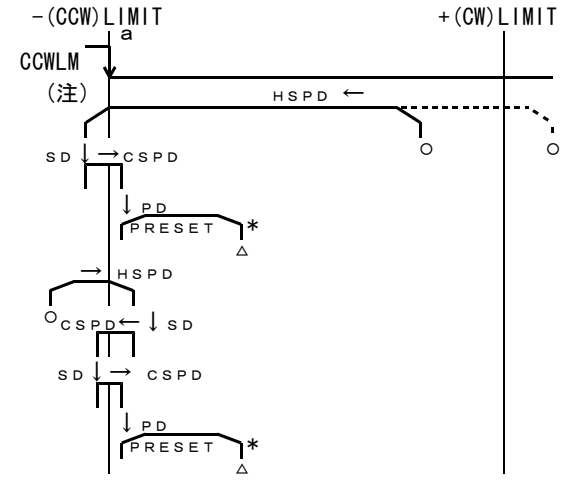


← Both $\overline{NORG}$ and $\overline{ORG}$ = On detected

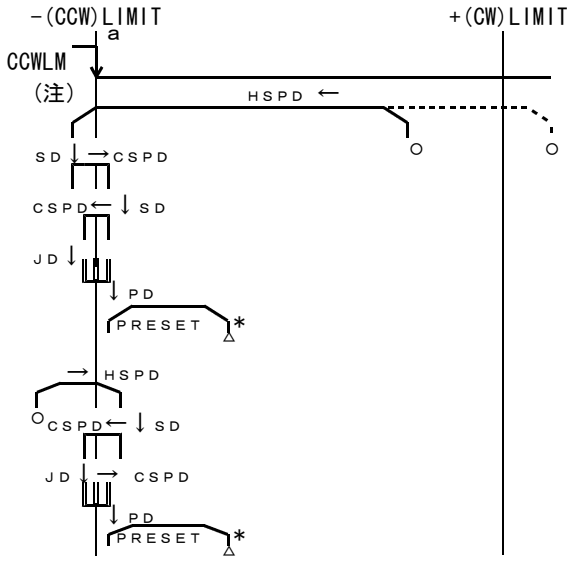
⚠ Caution The motor may run into a mechanical limit, damaging mechanical parts, workpieces or the like. If you have changed RATE, HSPD or other parameters, the relevant stopping points would vary. It is, therefore, required to verify the distance to the mechanical limit.

For ORG-11 and -12, a motor stop by Limit during ORG detection is defined as a decelerating stop.

■ORG-11



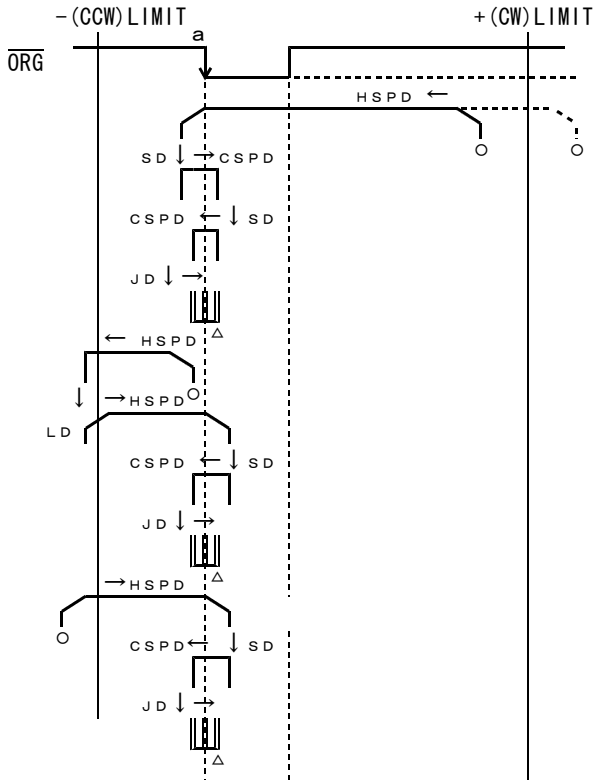
■ORG-12



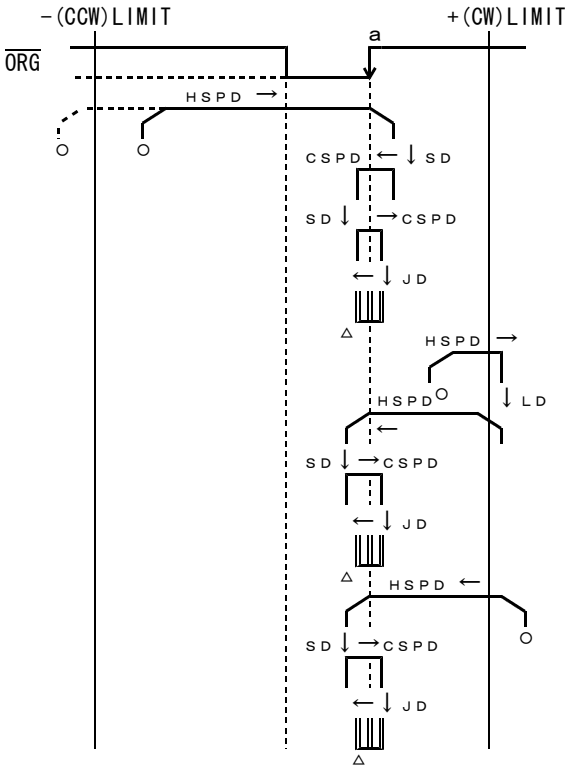
(5)ORG DRIVE DIRECTION

The ORG or NORG sensor can be attached to CW (+) Limit using the function that sets the direction for ORG DRIVE.

■ Example of sensor attached to CCW (-) Limit for ORG-3



■Example of sensor attached to CW (+) Limit for ORG-3



(6)HIGH SPEED ORG DRIVE (high-speed machine home detection)

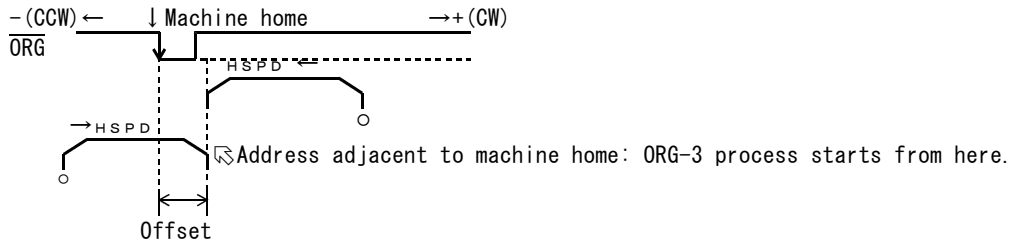
The HIGH SPEED ORG DRIVE stores the address of the machine home once found, which is used for the subsequent ORG DRIVE cycles to shorten the time taken to detect the machine home.

On activation of an ORG DRIVE, an ACCEL/DECEL DRIVE is executed until the address adjacent to home (machine home + offset) is found, after which the controller enters into the programmed ORG DRIVE process.

- When ORG DIRECTION is set to CW (+), the offset is applied to CCW (-).
- On activation of an ORG DRIVE,the controller immediately enters into the programmed ORG DRIVE process without executing an ACCEL/DECEL DRIVE is executed until the address adjacent to home (machine home + offset) is found if:

- HIGH SPEED ORG (Write Data No. ㇵ ㇱ) is not set to 1.
- ORG-10 is selected.
- An ORG DRIVE is activated for the first time after power-up or reset.
- An ORG DRIVE is activated for the first time after an immediate stop caused by CWLM, CCWLM or $\overline{\text{STOP}}$ input.
- An ORG DRIVE (except PRESET) is activated for the first time after a decelerating stop caused by $\overline{\text{STOP}}$ input.
- An ORG DRIVE is activated for the first time after ORG TYPE modified.
- The address is out of the range between +8,388,607 and -8,388,607.
- An ORG DRIVE fails to detect the home.

■Example of ORG-3



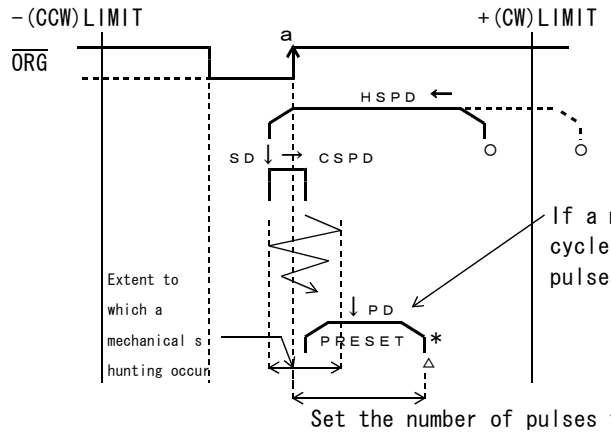
(7)PRESET DRIVE

The PRESET DRIVE automatically positions the motor to the number of preset pulses in the preset direction after the machine home is detected.

- Stable home detection operation can be achieved by appropriately adjusting the position for home position (ORG) in the last process of the ORG detection cycle to avoid the extent to which a mechanical hunting occurs.
- When specifying another electrical zero after ORG detection, programming preset pulses eliminates the need for automatically running the motor with PRESET DRIVE to that electrical zero and issuing an R. P. SET.

Example: To provide stable home detection operation by avoiding the detection of the extent to which a mechanical hunting occurs in an ORG DRIVE cycle.

■ORG-0



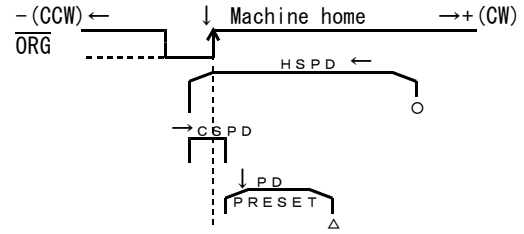
If a mechanical hunting results in an unsteady ORG DRIVE cycle, run the motor with a PRESET DRIVE as long as a few pulses are output to stabilize it.

Set the number of pulses to prevent a mechanical hunting.

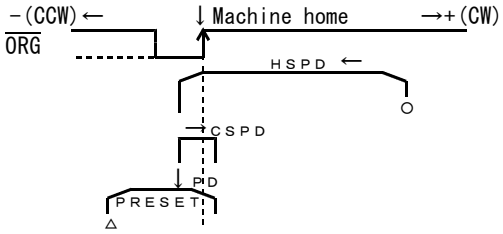
(8)PRESET DIRECTION

The PRESET DIRECTION runs the motor CCW (-) with PRESET DRIVE (CCW) by setting the direction with PRESET DIRECTION.

■For PRESET CW (+) (factory setting)



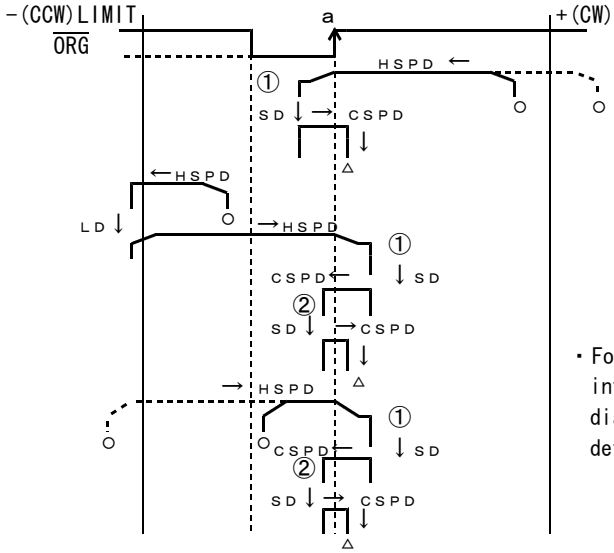
■For PRESET CCW (-)



(9)MARGIN TIME

The MARGIN TIME inserts a margin for time (delay time) between the moment an ORG sensor output is detected and the moment the pulse output stops in each process to adjust the travel beyond the sensor position, preventing a malfunction resulted from a mechanical hunting.

Example: For ORG-0



①When the ORG detection has caused the motor to decelerate to a speed set in LSPD, it is run at a constant low speed for a period of time set as the margin for time.

②After ORG is detected, the motor runs for a period of time set as the margin for time before stopping.

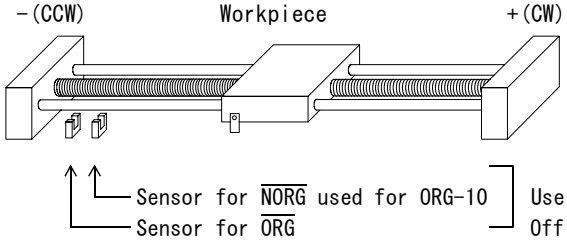
- For ORG-4 and -5, the margin for time is not inserted into a Constant Speed Drive cycle that is activated immediately before moving from NORG detection process to ORG detection process.

(10)Sensor locations

■For ORG-0, -1, -2, -3, and ORG-10

・Attach the sensors for $\overline{\text{ORG}}$ and $\overline{\text{NORG}}$, $\overline{\text{ORG}}$ signals to the side corresponding to the direction set with ORG DIRECTION.

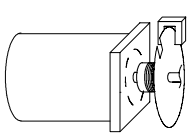
Example: When ORG DIRECTION has been set to CCW (-) on a ballscrew driven table



■For ORG-4 and -5

・Attach the sensor for $\overline{\text{NORG}}$ to the side corresponding to the direction set with ORG DIRECTION as above.

・When using a stepping motor, attach the sensor for $\overline{\text{ORG}}$ to its rotary shaft as shown below.


Sensor for ORG
Use a photo sensor that outputs H level at light input.
STEPPING MOTOR
Disc with slit attached to rotary shaft

■For ORG-11 and -12

・Since these types use a LIMIT signal as an $\overline{\text{ORG}}$ signal, they need limit sensors only.

・For ORG-11 and -12, $\overline{\text{ORG}}$ signals are valid.
It is, therefore, required to guarantee these signals are not active.

(11)Conditions for detecting machine home

■Any sensor used for the controller must interface with it from +24V.

■When using $\overline{\text{ORG}}$, $\overline{\text{NORG}}$ and LIMIT signals as ORG sensors, chattering must be eliminated from the LIMIT signal. (When using a photo sensor, chattering does not cause problems.)

■The output of the following sensor signals detected must be 1ms or more in time when a motor passes the sensors at a maximum speed.

・$\overline{\text{ORG}}$ signal for ORG-0, -1, -2, and -3

・$\overline{\text{NORG}}$ signal for ORG-4, -5, and -10

・LIMIT for ORG-11 and -12

■For ORG-4, -5, and -10, the distance between $\overline{\text{ORG}}$ and $\overline{\text{NORG}}$ (between points and b and between points a and c) must be more than N pulses in terms of the number of pulses obtained from the following equation.

$$\boxed{N \geqq 0.005 \times CSPD}$$ (Assuming that CSPD is in Hz and the minimum value of N is 1.)

Example) Where CSPD = 5kHz
N= 0.005×5000 = 25 pulses or more
(in practice, an appropriate allowance should be added to the calculated value)

■The following distances shown in the ORG DRIVE process charts must be long enough to allow the motor to decelerate and then stop.

・Distance between point a and LIMIT shown in each process chart

・Distance between points a and b shown in ORG-10

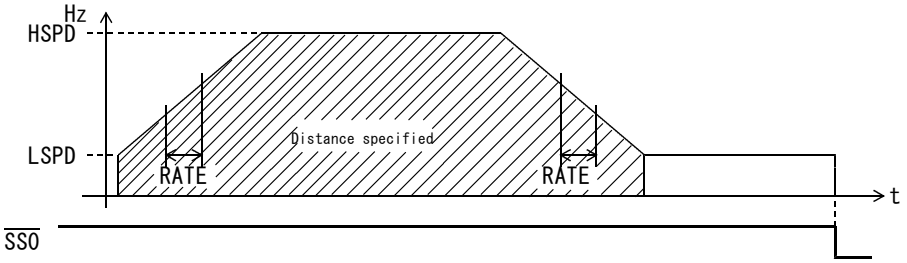
・Distance between point a and mechanical limit shown in ORG-11 and -12.

■To use ORG-11 and -12, $\overline{\text{ORG}}$, +ZORG and -ZORG must be not active.

8-7.SENSOR DRIVE

(1)SENSOR DRIVE (TYPE 0)

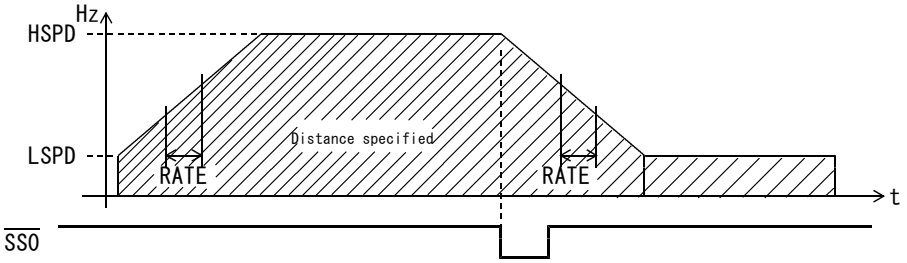
Moves the motor at a constant speed after an INCREMENTAL INDEX DRIVE and then stops it when a sensor ($\overline{SSO}$) signal is issued.



- The maximum pulses output by this function are 16,777,215. When no sensor ($\overline{SSO}$) signal is issued, the motor automatically stops when the maximum pulses have been output.
- With LSPD?HSPD, the motor is moved at a constant speed specified with HSPD.
- During an INCREMENTAL INDEX DRIVE, a sensor ($\overline{SSO}$) signal is ignored.
  With LSPD≧HSPD specified, the motor stops when an $\overline{SSO}$ signal is issued during an INCREMENTAL INDEX DRIVE.

(2)SENSOR DRIVE (TYPE 1)

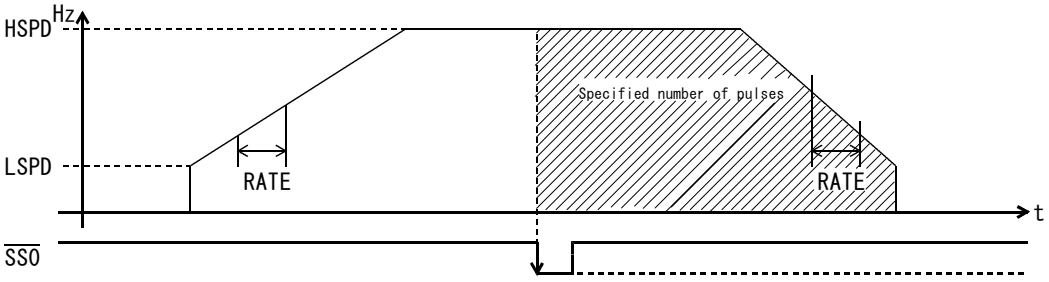
When a sensor ($\overline{SSO}$) signal is issued during an INCREMENTAL INDEX DRIVE, the motor decelerates and then moves at a constant speed.



- If a sensor output is detected before the motor being accelerated to a speed specified with HSPD, it starts decelerating.

(3)SENSOR DRIVE (TYPE 4)

The motor moves the specified number of pulses when a sensor ($\overline{SSO}$) signal is issued.
When started, this function performs the same motor motions as those for SCAN DRIVE and, when $\overline{SSO}$ detected, performs an INCREMENTAL INDEX DRIVE before stopping the motor.

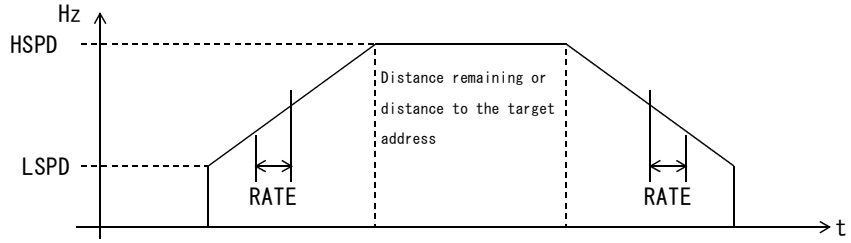


- With LSPD≧HSPD specified, the motor is moved at a constant speed specified with HSPD.
- The maximum speed is limited to a speed at which the motor can decelerate to stop by the number of pulses specified.
  As a result, the motor cannot reach the specified speed if fewer pulses specified.
- The SENSOR DRIVE runs by detecting the falling edge of a sensor input.
  There is no error in the number of pulses output after the falling edge is detected.
  It is not possible to set the number of pulses to zero (0).

8-8.REST DRIVE

When the controller activates the REST DRIVE without starting other motion after a motion using an INCEREMENTAL INDEX DRIVE or ABSOLUTE INDEX DRIVE and SENSOR DRIVE decelerated to stop by a $\overline{\text{STOP}}$ signal, it continues performing the rest of the steps.
The REST DRIVE is disabled for all motions performed by M. SCAN DRIVE, M.CSCAN DRIVE and SENSOR DRIVE TYPE4 after decelerating to stop by a $\overline{\text{STOP}}$ signal.

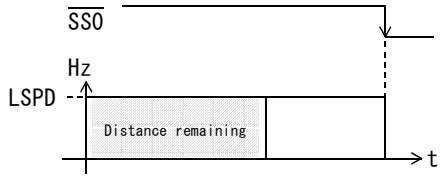
(1)PRESET DRIVE for INDEX and RTN DRIVE



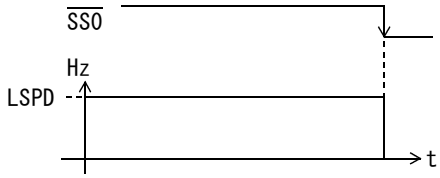
・With LSPD≧HSPD, the motor is moved at a constant speed specified with HSPD.
・If half of the remaining pulses is output before the motor being accelerated to a speed specified with HSPD, it starts decelerating. Where the result of adding the number of pulses remaining in an INCREMENTAL INDEX DRIVE motion to the current position address exceeds the range between -8388607 and +8388607, an allowable range for managing addresses, no motions are performed, resulting in a REST DRIVE error and Err09H status output.

(2)REST DRIVE for SENSOR DRIVE (TYPE 0)

【When the number of pulses remaining ＝ 0】
The motor is moved at a constant speed after completing a motion that corresponds to the remaining pulses until a sensor ($\overline{\text{SSO}}$) signal is issued.

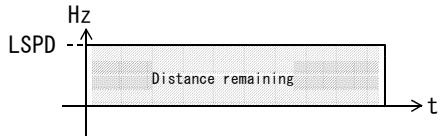


【When the number of pulses remaining = 0】
The motor is moved at a constant speed until a sensor ($\overline{\text{SSO}}$) signal is issued.



(3)REST DRIVE for SENSOR DRIVE (TYPE 1)

The motor is moved at a constant speed by the remaining pulses with a sensor ($\overline{\text{SSO}}$) signal input disabled.



(4)REST DRIVE for ORG DRIVE

The controller re-executes an ORG DRIVE from the beginning.

8-9.Metric (angular) Conversion

■ Metric (mm) conversion To perform metric conversion, set the metric (angular) conversion constant in 0.01μm.

■ Angular conversion To perform angular conversion, set the metric (angular) conversion constant in 0.00001°.

■ Examples of maximum settings

【Example of metric (mm) conversion】

Conversion constant	Maximum setting
0.1μm (Conversion constant=10)	838.8607mm
0.2μm (Conversion constant=20)	999.9998mm
0.25μm (Conversion constant=25)	99.99975mm
0.4μm (Conversion constant=40)	999.9996mm
0.5μm (Conversion constant=50)	999.9995mm
1μm (Conversion constant=100)	8388.607mm
2μm (Conversion constant=200)	9999.998mm
2.5μm (Conversion constant=250)	999.9975mm
4μm (Conversion constant=400)	9999.996mm
5μm (Conversion constant=500)	9999.995mm
10μm (onversion constant=1000)	83886.07mm
20μm (onversion constant=2000)	99999.98mm
25μm (onversion constant=2500)	9999.975mm
40μm (onversion constant=4000)	99999.96mm
50μm (onversion constant=5000)	99999.95mm

【Example of angular conversion】

Conversion constant	Maximum setting
0.009° (Conversion constant=900)	9999.999°
0.018° (Conversion constant=1800)	9999.990°
0.0225° (Conversion constant=2250)	999.9900°
0.036° (Conversion constant=3600)	9999.972°
0.045° (Conversion constant=4500)	9999.990°
0.072° (Conversion constant=7200)	9999.936°
0.09° (Conversion constant=9000)	99999.99°
0.1125° (Conversion constant=11250)	999.9000°
0.18° (Conversion constant=18000)	99999.90°
0.225° (Conversion constant=22500)	9999.900°
0.36° (Conversion constant=36000)	99999.72°
0.45° (Conversion constant=45000)	99999.90°
0.72° (Conversion constant=72000)	99999.36°
0.9° (Conversion constant=90000)	999999.9°

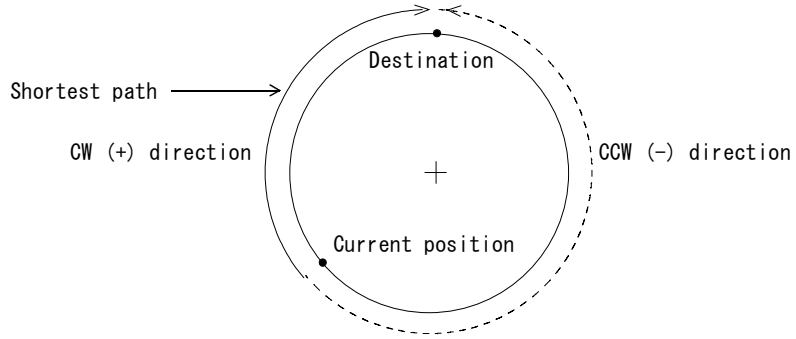
・Where a certain value cannot be divided by the conversion constant entered, the remainder is dropped before being written to the CAD-5411S-570.
Example: Where the metric (angular) conversion constant is set to 5μm and the distance 0.143mm, the remainder of this division is rounded to 0.140mm before being written to the CAD-5411S-570, the result "0.140" being display on the panel.

・Where the metric (angular) conversion constant is set to 0, no conversion is performed, the values being in pulses.

・Where a step angle cannot be divided by a specific constant, you cannot use the metric (angular) conversion. Use conversion constant = 0 (pulses) instead.

8-10.Shortest-Distance Indexing

When activating INDEX00-INDEX50 DRIVE or RTN DRIVE with the Shortest-Distance Indexing enabled, the controller automatically determines the direction of rotation that allows the motor to quickly move from the current position to a target position and then moves the motor the shortest distance.



- With this function enabled, INDEX00 through INDEX50 are of absolute and the sign fixed to plus (+).
- When the distance between the current position and the destination is the same for both directions, CW (+) and CCW (-), the motor move CW (+).
- With the Shortest-Distance Indexing enabled, the SENSOR DRIVE is not available.

■To perform the angular conversion:

- Set the metric (angular) conversion constant in 0.00001°.
- Obtain the metric (angular) conversion constant by the number of pulses per revolution in the Shortest-Distance Indexing using the following equation.

Millimeter (angular) conversion constant = Step angle x 100,000

$$\text{Step angle} = \frac{360^\circ}{\text{Number of pulses per revolution for Shortest-Distance Indexing}}$$

- Where a step angle cannot be divided by a specific constant, set the metric (angular) conversion constant to zero (pulses).

■Example of angular conversion

Step angle	Conversion constant	Maximum setting	Pulses per revolution
0.009°	900	359.991°	40,000
0.018°	1800	359.982°	20,000
0.036°	3600	359.964°	10,000
0.045°	4500	359.955°	8,000
0.072°	7200	359.928°	5,000

Step angle	Conversion constant	Maximum setting	Pulses per revolution
0.09°	9000	359.91°	4,000
0.18°	18000	359.82°	2,000
0.36°	36000	359.64°	1,000
0.45°	45000	359.55°	800
0.72°	72000	359.28°	500

8-11.Teaching Specifications

> ⚠ **Caution**
> Mechanical damage or personal injury may occur.
> When teaching positions during adjustment, be sure to run the motor at a safe speed provided for teaching.

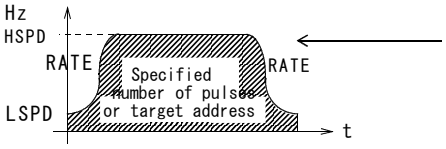
(1)Teaching methods

The CAD-5411S-570 allows teaching in an External Mode and via the panel.

Teaching method	Application
Teaching via CAD-5411S-570 panel	A method that operates the CAD-5411S-570 via the panel independently of a host.Use to operate the controller alone during the adjustment ofmechanisms or maintenance.
Teaching Mode (external control)	A method that provides control via sequencer I/O outputs using a touch panel.Used as overall controller functionality including the change of setups involved in fine adjustments.

(2)Teaching speed

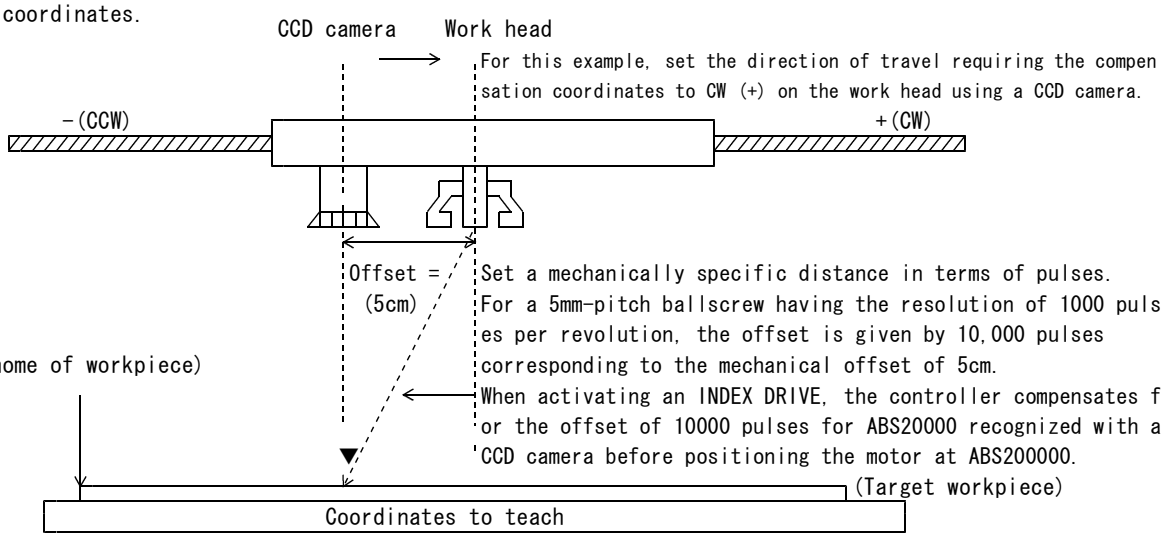
You can set both the normal operating speed and the speed at which the motor is run in the Teaching Mode.

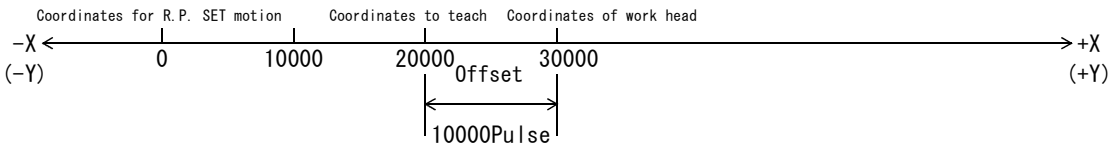


Applied to ORG, SCAN, INDEX, and RTN DRIVE functionsIt is possible to set the speed for each of HSPD and TSPD.
Set the speed to ensure that the motor is run safety at TSPD in the Teaching Mode.

(3)Compensation of Coordinates

For a mechanism whose coordinates taught using a CCD camera or the like differ from those applied to machine workpieces, it is possible to change the position of workpiece when the motor is run in an INDEX DRIVE to that captured with a device (e.g. CCD camera) to provide compensation of the coordinates.


CCD camera
Work head
For this example, set the direction of travel requiring the compensation coordinates to CW (+) on the work head using a CCD camera.
-(CCW)
+(CW)
Offset =
(5cm)
Set a mechanically specific distance in terms of pulses.
For a 5mm-pitch ballscrew having the resolution of 1000 pulses per revolution, the offset is given by 10,000 pulses corresponding to the mechanical offset of 5cm.
When activating an INDEX DRIVE, the controller compensates for the offset of 10000 pulses for ABS20000 recognized with a CCD camera before positioning the motor at ABS200000.
(home of workpiece)
(Target workpiece)
Coordinates to teach



- When externally operating the controller, the compensation of coordinates is enabled in a Normal Mode and disabled in a Trace Mode.
- When operating the controller in Teaching Mode via the panel, the compensation of coordinates can be enabled or disabled with the H/B key.
- When operating the controller in S-Curve Adjust Mode via the panel, the compensation of coordinates is enabled.
- With the Shortest-Distance Indexing enabled, the compensation of coordinates is disabled.

8-12.Miscellaneous Specifications on Timing

Status	Necessary signal input width	Time until signal reply	Time until $\overline{RDY}$=L	Remarks
POWER ON	(Power On ≦200ms)	≦400ms	≦1s	
$\overline{RESET}$	≧6ms	≦15ms	≦1s	
LIMIT Stop	≧400μs	Within 1 pulse after detection	From drive stop ≦300μs	
$\overline{STOP}$ (Immediate stop)	≧400μs (Until RDY=LOW)	≦300μs Within 1 pulse after detection	From pulse stop ≦300μs	
$\overline{STOP}$ (Stop after deceleration)	≧400μs (Until RDY=LOW)	≦300μs The output pulse depends on the speed at the time of $\overline{STOP}$. Within 1 pulse at the time of constant speed.	From drive stop ≦300μs	In the acceleration/deceleration drive, the speed depends on pulse number to be output at the time of deceleration.

■POWER ON

When the power supply is correctly turned on, the inside of CAD-5411S-570 is initialized and the sequencer control turns into the Normal Mode.
Moreover, excitation-phase of a driver is initialized. The power LED of a driver lights up.

- Turn on the +24V power supply of CAD-5411S-570 before or at the same time when turning on the power supply of the sequencer.
- Turn on the AC power supply befor or at the same time when turnnig on the +24V power supply.

■$\overline{RESET}$ Signal

When the $\overline{RESET}$ signal is input, the motion stops, and when the signal is released, the inside of CAD-5411S-570 is initialized (Address 0), and the sequencer control turns into the Normal Move.

- The pulse number to be output after CAD-5411S-570 detected the $\overline{RESET}$ signal is not more than 1 pulse.
- Since the $\overline{RESET}$ signal contains CR time constant, there will be a delay up to 15ms by the time when CAD-5411S-570 detects the signal inside.

■CWLM and CCWLM Signals

LIMIT signals (CWLM, CCWLM) input to CAD-5411S-570 stops pulse output of the immediately.
Err00H status is output in case of CW direction, and Err01H status is output in case of CCW direction.

- The pulse number to be output after CAD-5411S-570 detected CWLM, CCWLM is not more than 1 pulse.
- Since the CWLM and CCWLM signals contain CR circuit, there will be a delay up to 300us by the time when CAD-5411S-570 detects the signals inside.

■$\overline{\text{STOP}}$ signal (Stop after deceleration)

When the $\overline{\text{STOP}}$ signal (stop after deceleration) is input, CAD-5411S-570 comes to a stop decelerating output frequency of PULSE.
Status 32H showing that the motion is at a halt is output that stopped after deceleration.
For which stop after deceleration is selected as the stop type, REST DRIVE from a halfway stop status is valid.

- Pulse number to be output after CAD-5411S-570 detects $\overline{\text{STOP}}$ signal (stop after deceleration)
  - ◇ is equal to the one to be output at the time of deceleration during the acceleration/ deceleration drive and depends on set values of HSPD, LSPD and RATE.
  - ◇ is less than 1 pulse during a constant speed drive.
- Since the $\overline{\text{STOP}}$ signal contains CR circuit, there will be a delay up to 300us by the time when CAD-5411S-570 detects the signal inside.
- Even when a motion stops after the $\overline{\text{STOP}}$ signal is input,the $\overline{\text{RDY}}$ signal does not become LOW while the $\overline{\text{START}}$ signal is LOW.

■$\overline{\text{STOP}}$ signal (Immediate stop)

When the $\overline{\text{STOP}}$ signal (immediate stop) is input to CAD-5411S-570, it stops pulse output immediately.
When the stopped immediately by $\overline{\text{STOP}}$ signal is set to output an error, the status of Err02H is output.
When the stopped immediately by $\overline{\text{STOP}}$ signal is set not to output an error,the status of 4EH is output.
When Immediate Stop is selected as the stop type, REST DRIVE becomes invalid.

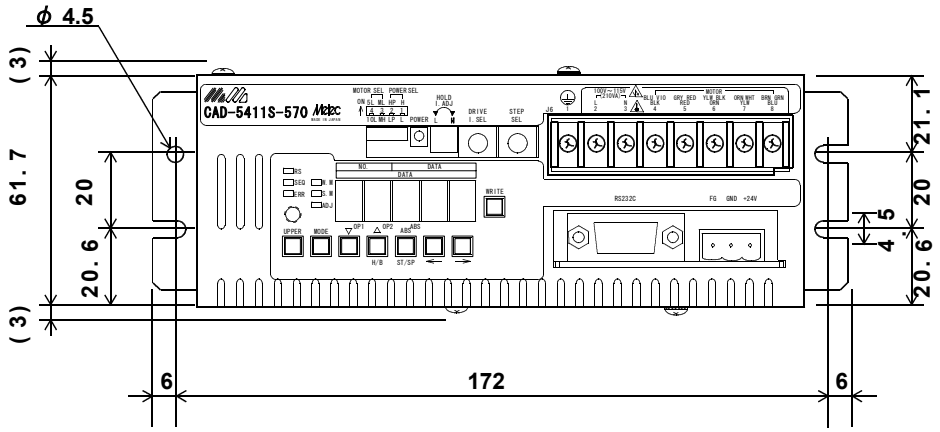
- The pulse number to be output after CAD-5411S-570 detected $\overline{\text{STOP}}$ (immediate stop) is not more than 1 pulse.
- Since the $\overline{\text{STOP}}$ signal or the FSSTOP signal contains CR circuit,there will be a delay up to 300us by the time when CAD-5411S-570 detects the signal inside.
- Even when a motion stops after the $\overline{\text{STOP}}$ signal is input,the $\overline{\text{RDY}}$ signal does not become LOW while the $\overline{\text{START}}$ signal is LOW.

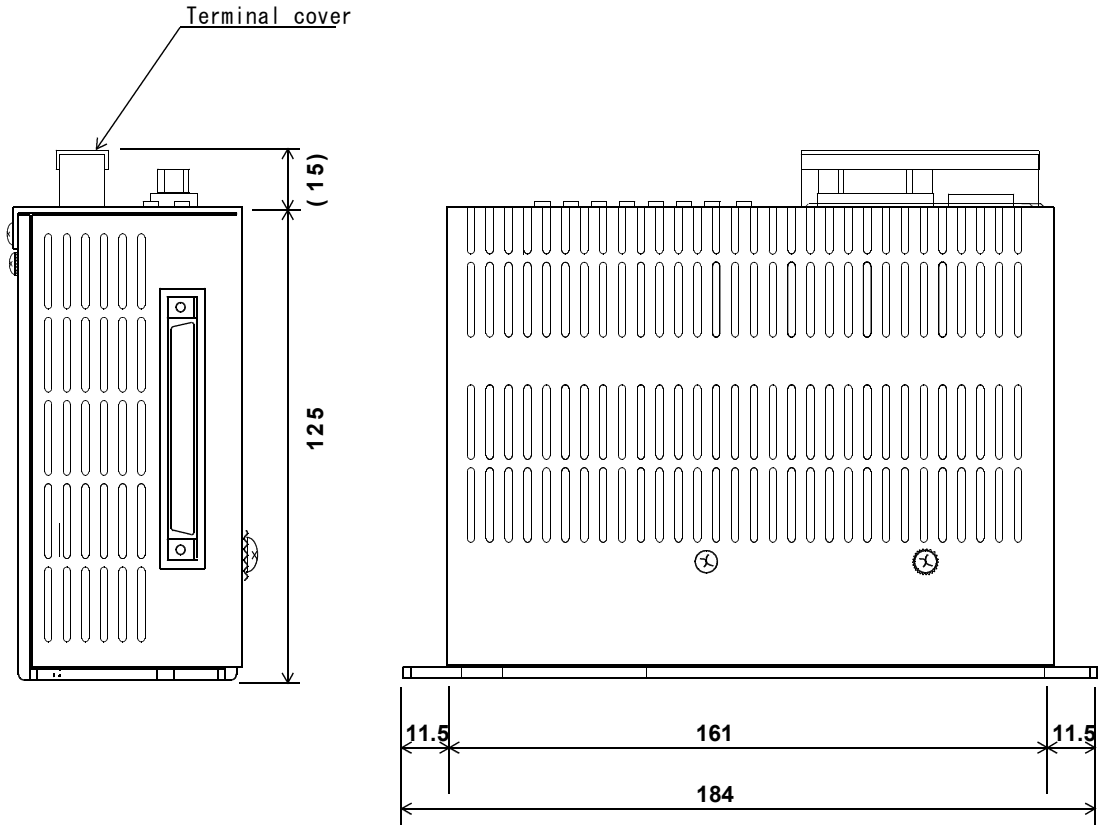
■$\overline{\text{ERR}}$ Signal

When CAD-5411S-570 detects an error like LIMIT signal input, the $\overline{\text{ERR}}$ signal is reported to the host sequencer.
The $\overline{\text{ERR}}$ signal is released by inputting $\overline{\text{START}}$ signal for the next motion command.
If the error status is not avoided after the next motion command is given, an $\overline{\text{ERR}}$ signal is reported again without motion.

8-13.External Dimensions

R2





9. Characteristic table

9-1.RATE Table

(1)RATE DATA Table

■L-TYPE

No.	ms/1000Hz
0	1000
1	800
2	600
3	500
4	400
5	300
6	200
7	150
8	125
9	100
10	75
11	50
12	30
13	20
14	15
15	10
16	7.5
17	5.0
18	4.0
19	2.0
20	1.5
21	1.0

■M1-TYPE(RESOLUTION10)

No.	ms/1000Hz
0	100
1	40
2	30
3	20
4	15
5	10
6	6.0
7	3.0
8	2.0
9	1.0
10	0.6
11	0.4
12	0.2
13	0.15
14	0.10

■M2-TYPE(RESOLUTION20)

No.	ms/1000Hz
0	50
1	20
2	15
3	10
4	7.5
5	5.0
6	3.0
7	1.5
8	1.0
9	0.5
10	0.3
11	0.2
12	0.1
13	0.075
14	0.05

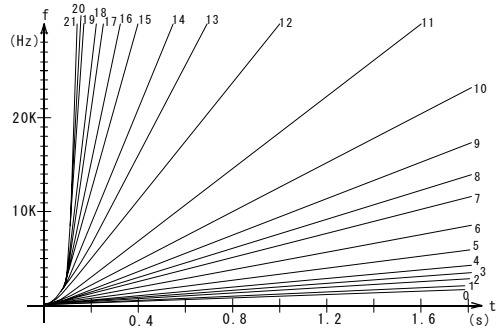
■H-TYPE

No.	ms/1000Hz
0	5.0
1	2.0
2	1.5
3	1.0
4	0.75
5	0.50
6	0.30
7	0.15
8	0.10
9	0.05
10	0.03
11	0.02
12	0.01
13	0.0075
14	0.005

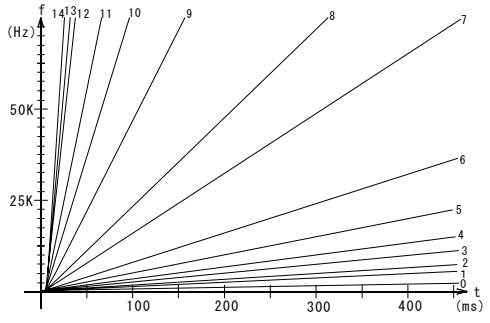
・ms/1000Hz indicates the average time necessary for acceleration or deceleration of 1000Hz.

(2)RATE Curve

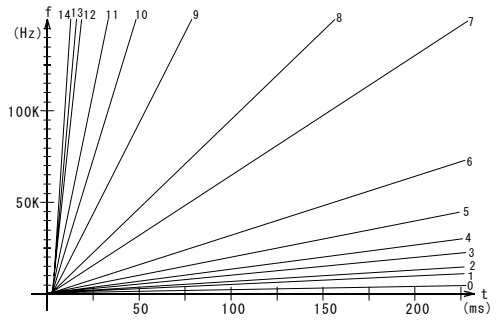
■L-TYPE



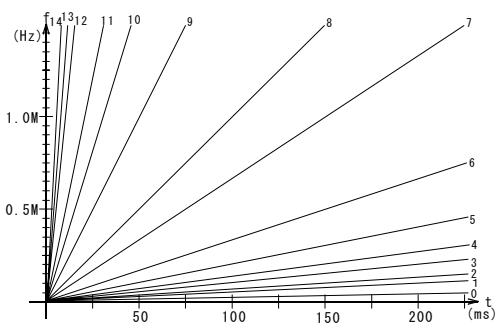
■M1-TYPE(RESOLUTION_10)



■M2-TYPE(RESOLUTION_20)



■H-TYPE



(3)Speed Difference in RATE TYPE

RATE TYPE	L-TYPE	M1-TYPE	M2-TYPE	H-TYPE
Speed difference	51Hz/STEP ～62Hz/STEP	500Hz/STEP ～2kHz/STEP	1kHz/STEP ～4kHz/STEP	10kHz/STEP ～68kHz/STEP

・Speed difference indicates the difference of speeds before and after speed changes in acceleration or deceleration.
The speed difference is not constant in all speed ranges and increasesgradually as the speed rises from low to high.

・The drive type is often set to M-Type when servo motors are used, but motor rotating noise and vibration are supposed to occur as an influenced of speed difference in acceleration and deceleration sometimes depending on conditions such as use of high gain servo and mechanical rigidity.
In this case, Type-M1 (RESO_10) can be selected to reduce noise and vibration.
However, the rate (accelerating time/1kHz) setting range of Drive Type-M1 (RESO_10) becomes slower than that of RESO_20.

9-2.Torque Characteristics

■Representatations in the torque characteristics table are made in terms of the motor rotation(s^{-1}) vs. torque(kg·cm).
Motor rotation(s^{-1}) and drive pulse frequency(pps) are converted as follws:

$$\text{Motor rotation}(s^{-1}) \times \frac{360^\circ}{\text{STEP angle}} = \text{drive frequency}(Hz)$$

●Motor rotation speed

Basic step angle 0.72° Motor: $70s^{-1}$
Basic step angle 0.36° Motor: $35s^{-1}$

■The self-start-up frequency is represented as「fs」by the value at zero inertial load.

■Upon operation, provide adequate allowance for torque.

■The stepping motor may attain high temperature, depending on the operational conditions.
If the surface temperature exceeds 100℃, provide cooling measure to control it to operate at 100℃ at the highest.

■Equivalent

・Torque
1kg·cm=0.0980665N·m
1N·m=10.1972kg·cm

・Rotation speed
s^{-1}=1rps

Fig.1

5M33HA(B)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

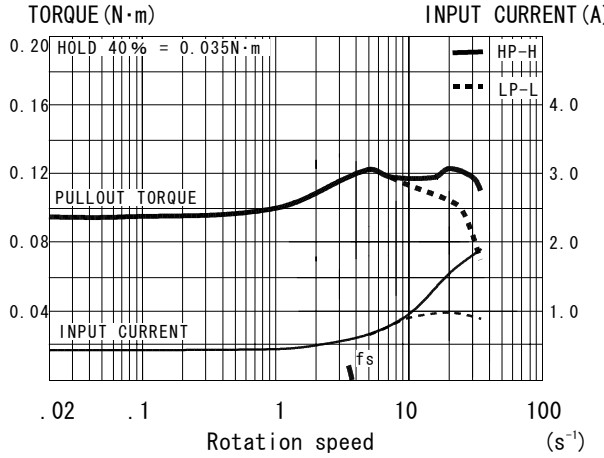


Fig.2

5M34HA(B)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

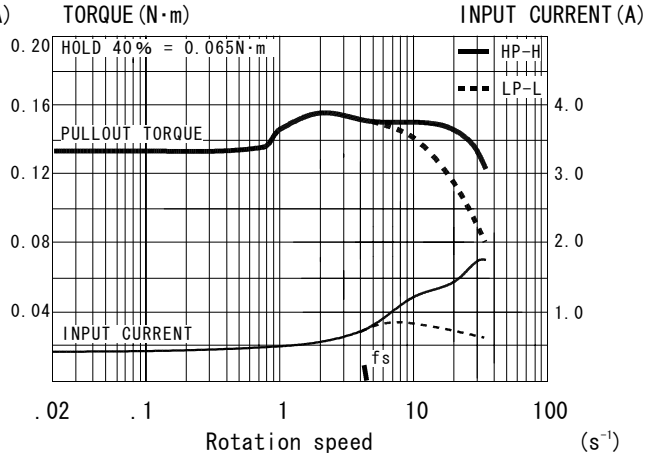


Fig.3

5M64A(B)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

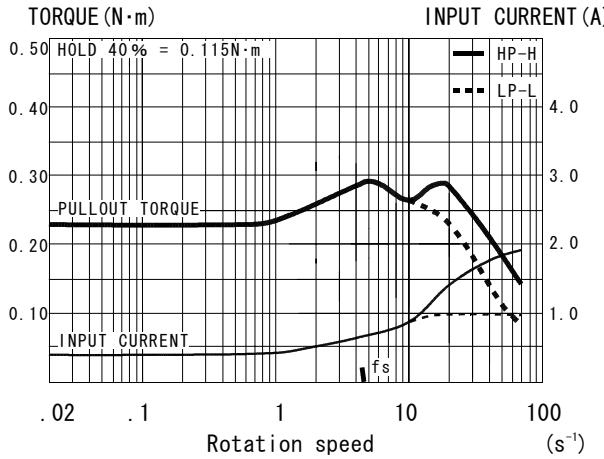


Fig.4

5M66HA(B)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

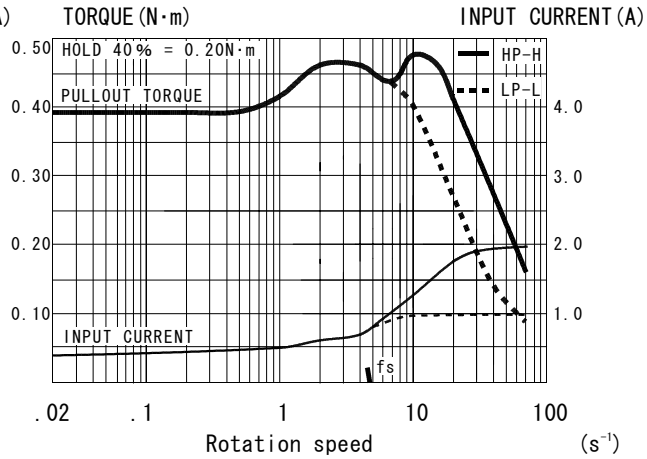


Fig.5

5M69A(B)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

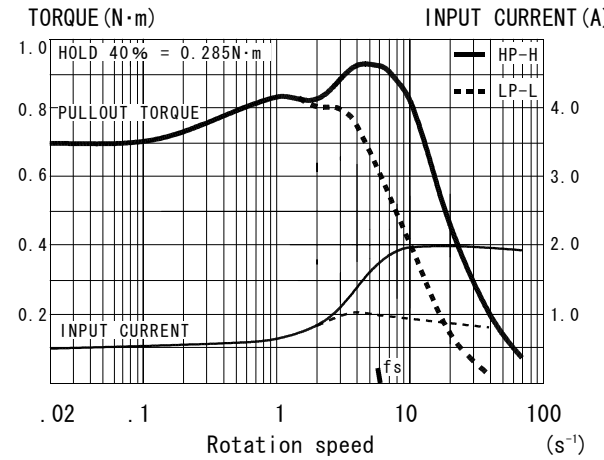


Fig.6

5M96A(B)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

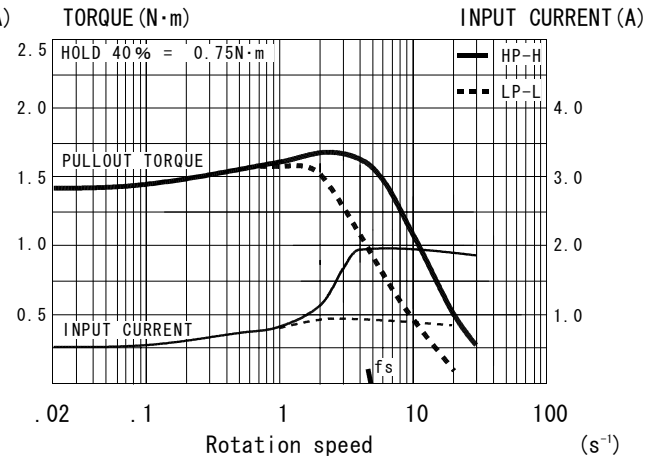


Fig.7

5M99A(B)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

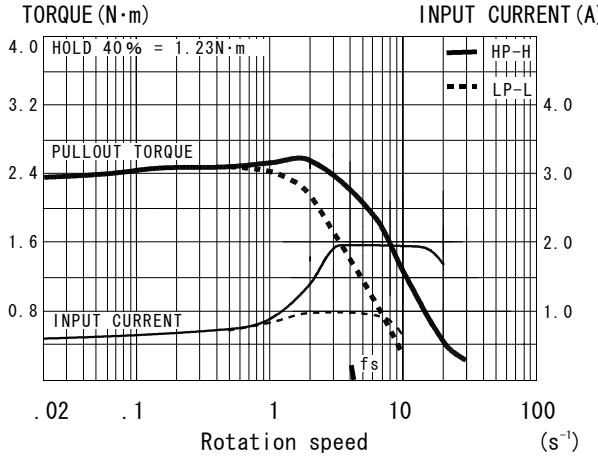


Fig.8

5M913A(B)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

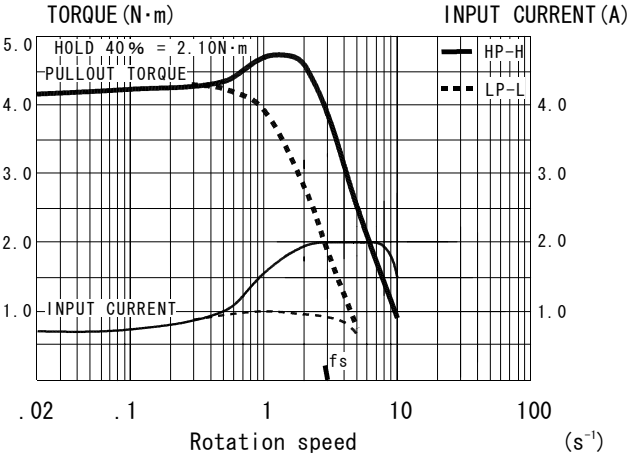


Fig.9

103H7521-7051(7021)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

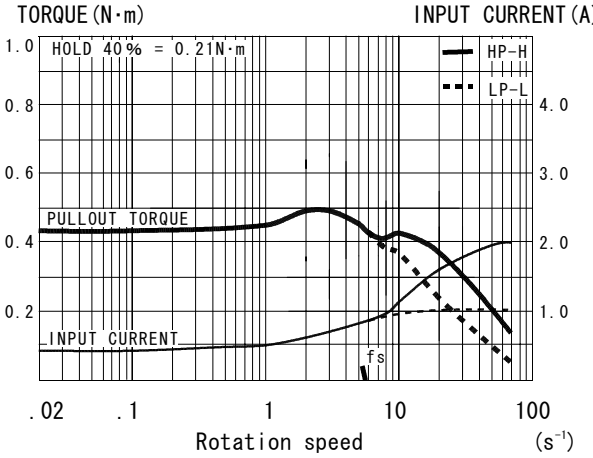


Fig.10

103H7522-7051(7021)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

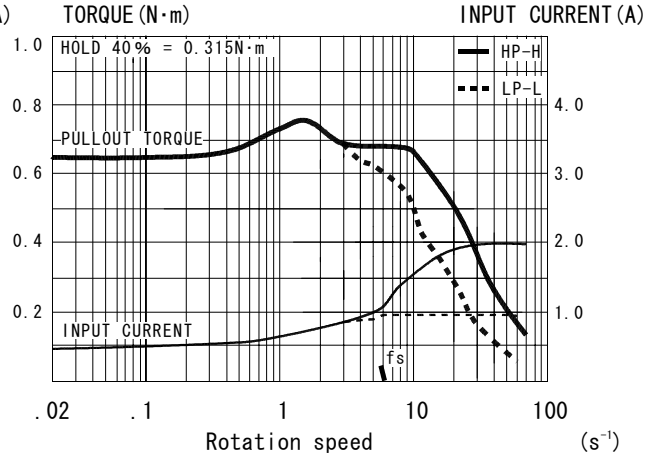


Fig.11

103H7523-7051(7021)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = NO.F
AC100V

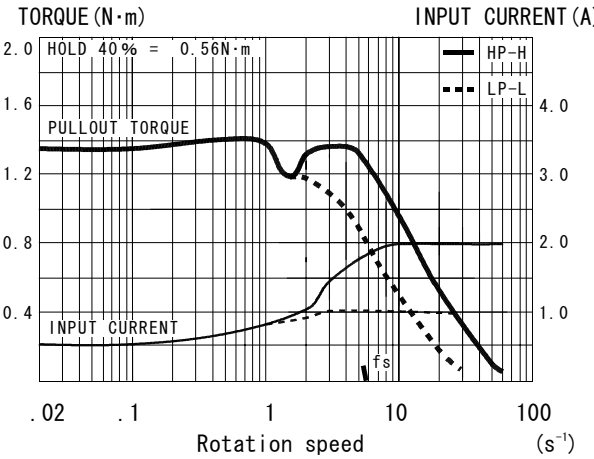


Fig.12

103H8581-7041(7011)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

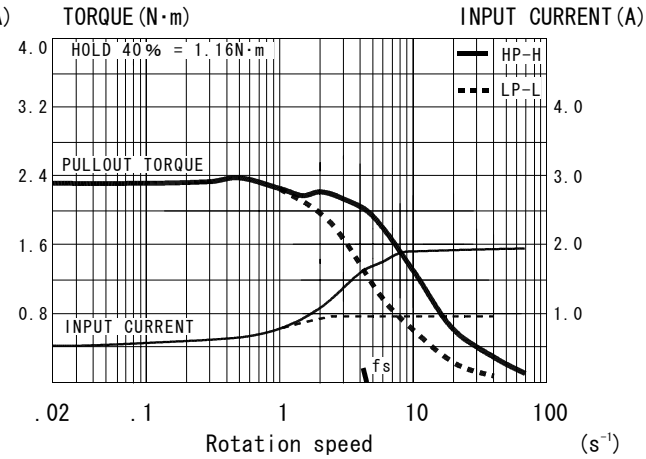


Fig.13

103H8582-7041(7011)
0.75A/PHASE

MOTOR SEL = MH,5L
DRIVE I.SEL = No.F
AC100V

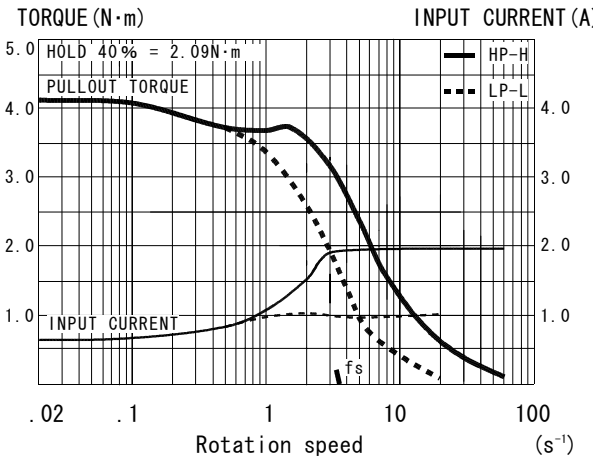


Fig.14

PX533MH-A(B)
0.75A/PHASE

MOTOR SEL = MH,10L
DRIVE I.SEL = No.6
AC100V

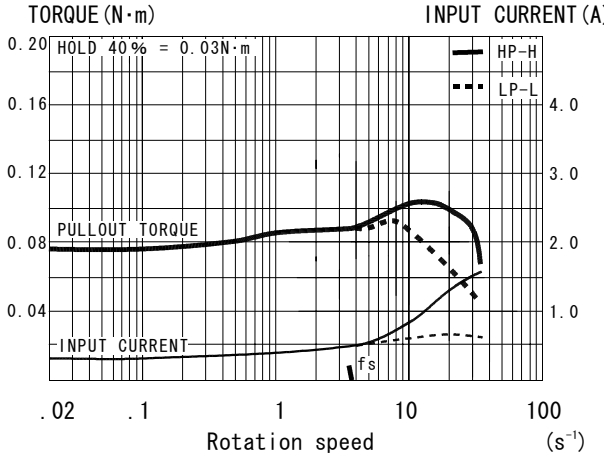


Fig.15

PX534MH-A(B)
0.75A/PHASE

MOTOR SEL = MH,10L
DRIVE I.SEL = No.6
AC100V

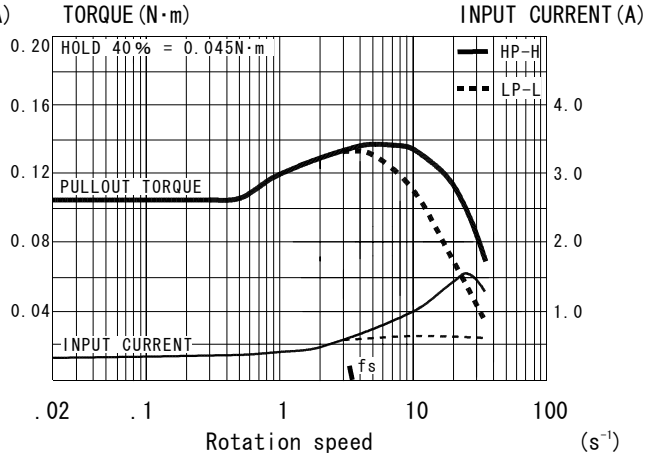


Fig.16

PX535MH-A(B)
0.75A/PHASE

MOTOR SEL = MH,10L
DRIVE I.SEL = No.6
AC100V

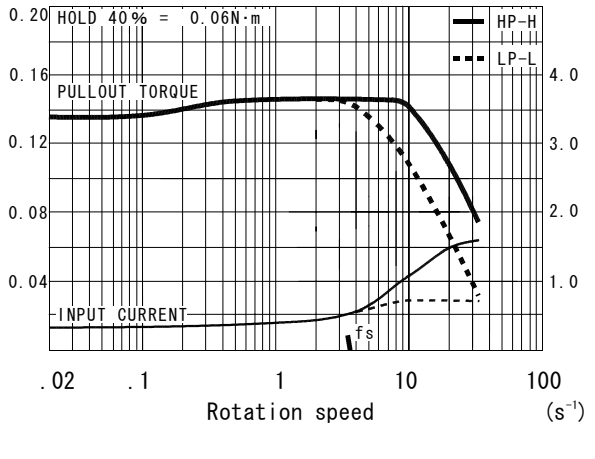


Fig.17

PH544-A(B)
0.75A/PHASE

MOTOR SEL = MH,10L
DRIVE I.SEL = No.6
AC100V

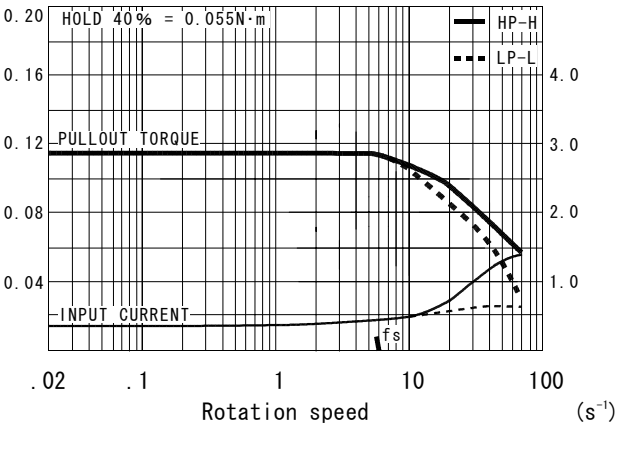


Fig.18

PH554-A_2(B)$_2$
0.75A/PHASE

MOTOR SEL = MH,10L
DRIVE I.SEL = No.6
AC100V

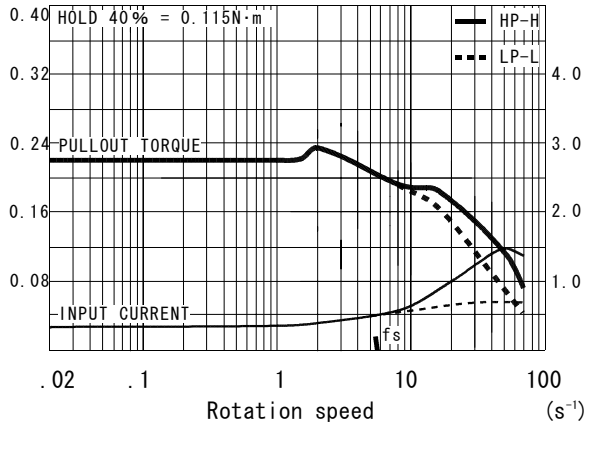


Fig.19

PH564-A(B)
0.75A/PHASE

MOTOR SEL = MH,10L
DRIVE I.SEL = No.6
AC100V

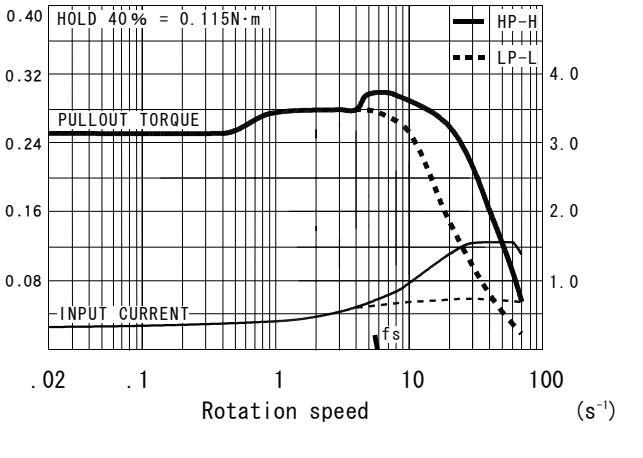


Fig.20

PH566-A(B)
0.75A/PHASE

MOTOR SEL = MH,1OL
DRIVE I.SEL = No.6
AC100V

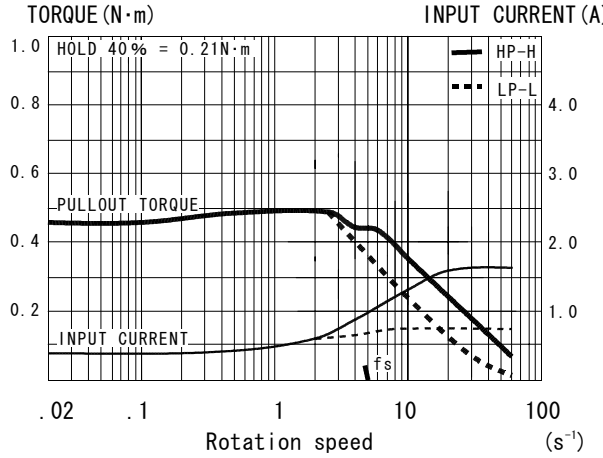


Fig.21

PH566H-A(B)
1.3A/PHASE

MOTOR SEL = MH,1OL
DRIVE I.SEL = No.E
AC100V

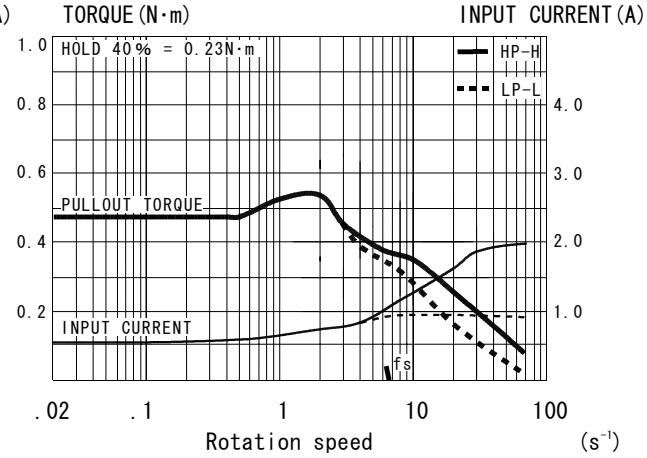


Fig.22

PH569-A(B)
1.4A/PHASE

MOTOR SEL = MH,1OL
DRIVE I.SEL = No.F
AC100V

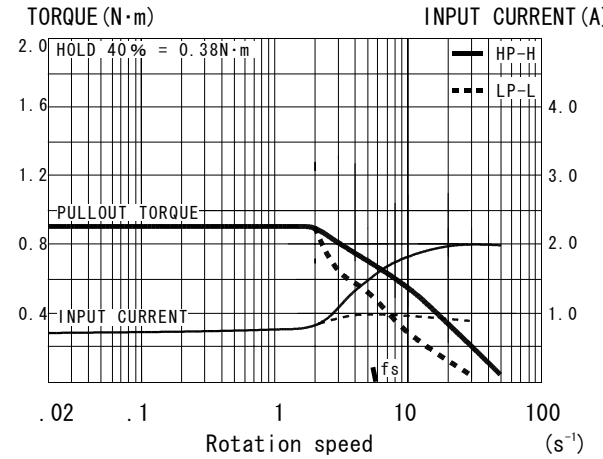


Fig.23

PH596-A(B)
1.25A/PHASE

MOTOR SEL = MH,1OL
DRIVE I.SEL = No.D
AC100V

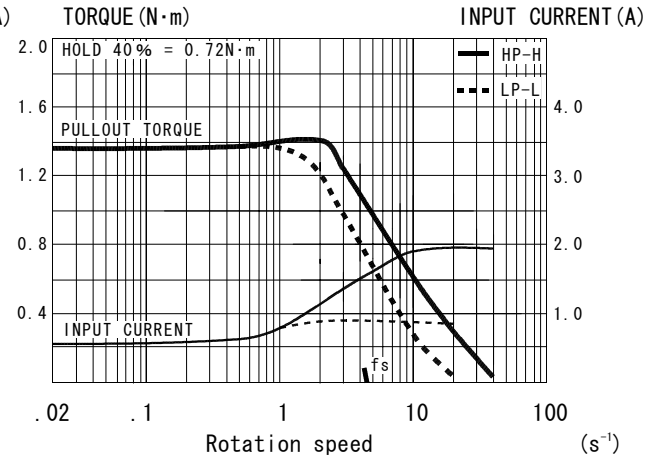


Fig.24

PH599-A(B)
1.15A/PHASE

MOTOR SEL = MH,1OL
DRIVE I.SEL = No.C
AC100V

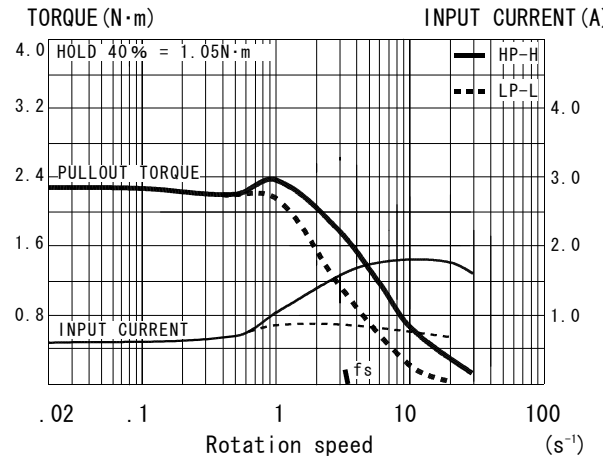


Fig. 25

PK543-A(B)
0.75A/PHASE

MOTOR SEL = MH, 10L
DRIVE I.SEL = No. 6
AC100V

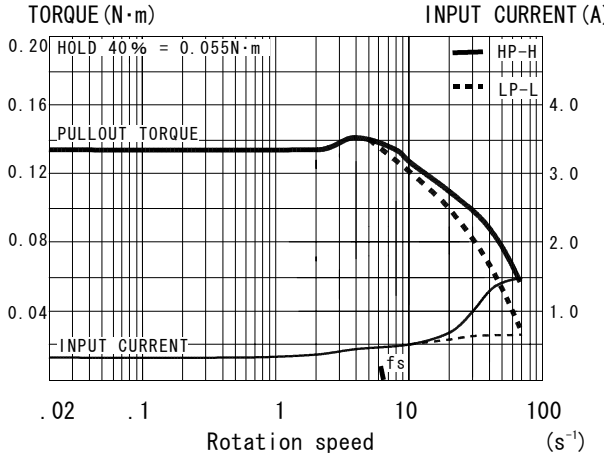


Fig. 26

PK544-A(B)
0.75A/PHASE

MOTOR SEL = MH, 10L
DRIVE I.SEL = No. 6
AC100V

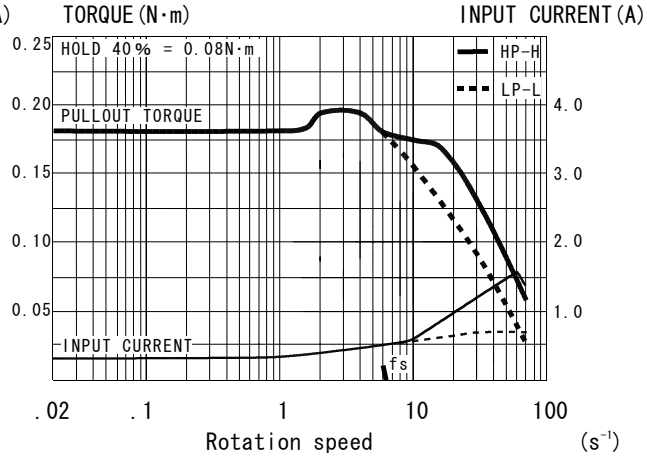


Fig. 27

PK545-A(B)
0.75A/PHASE

MOTOR SEL = MH, 10L
DRIVE I.SEL = No. 6
AC100V

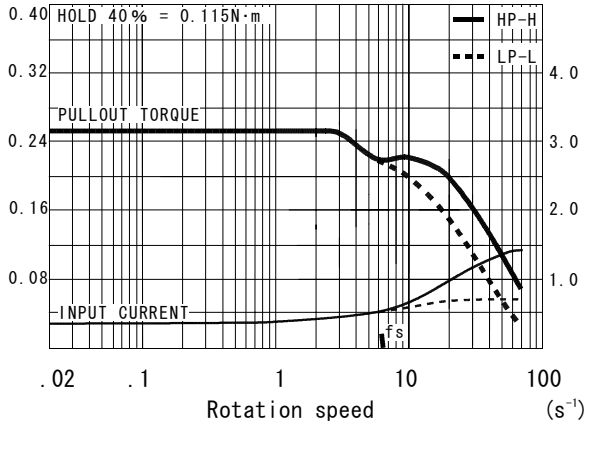


Fig. 28

PK564-A(B)
0.75A/PHASE

MOTOR SEL = MH, 10L
DRIVE I.SEL = No. 6
AC100V

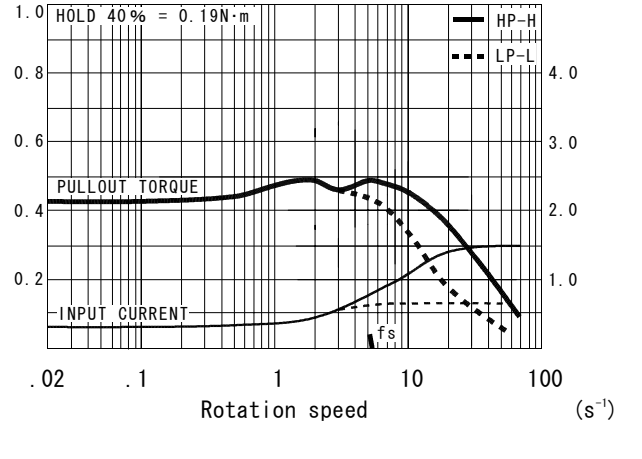


Fig. 29

PK566-A(B)
0.75A/PHASE

MOTOR SEL = MH, 10L
DRIVE I.SEL = No. 6
AC100V

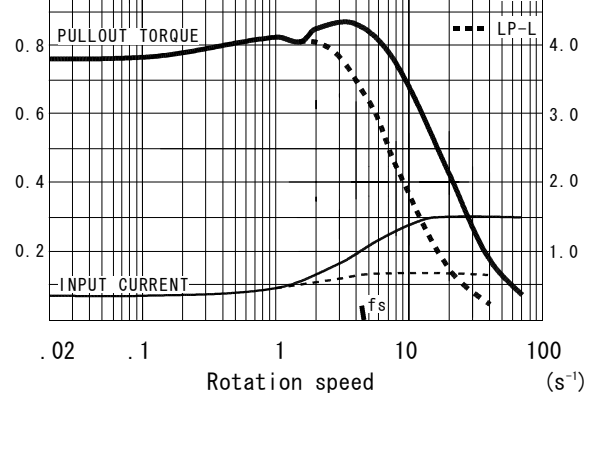


Fig. 30

PK564H-A(B)
1.4A/PHASE

MOTOR SEL = MH, 10L
DRIVE I.SEL = No. F
AC100V

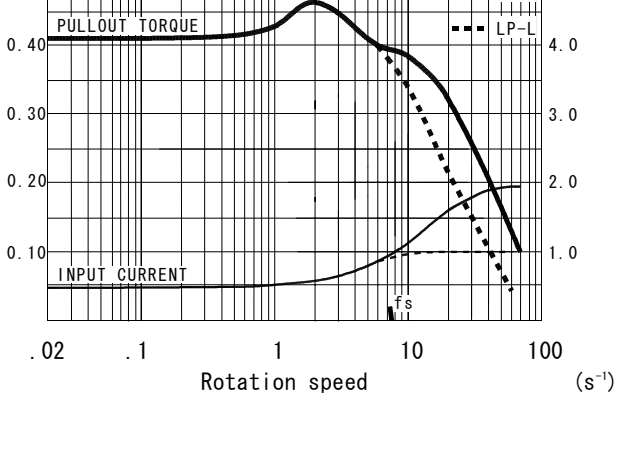


Fig.31

PK566H-A(B)
1.4A/PHASE

MOTOR SEL = MH,1OL
DRIVE I.SEL = No.F
AC100V

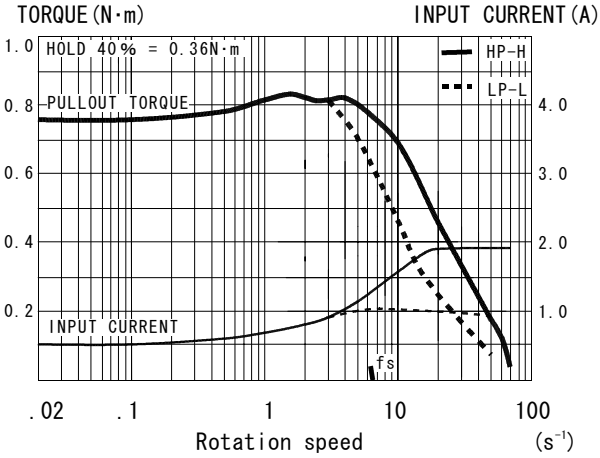


Fig.32

PK569-A(B)
1.4A/PHASE

MOTOR SEL = MH,1OL
DRIVE I.SEL = No.F
AC100V

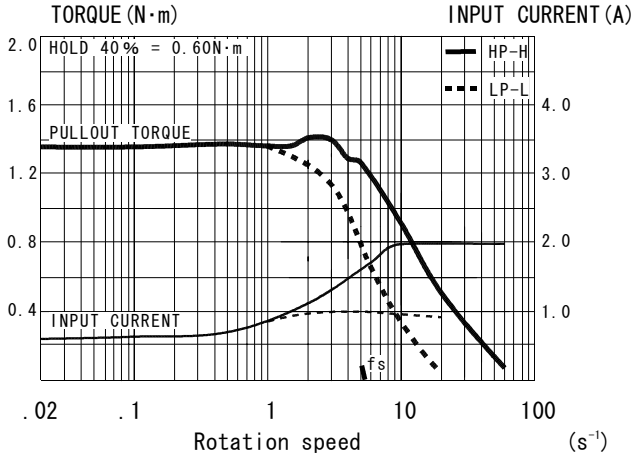


Fig.33

PK596-A(B)
1.4A/PHASE

MOTOR SEL = MH,1OL
DRIVE I.SEL = No.F
AC100V

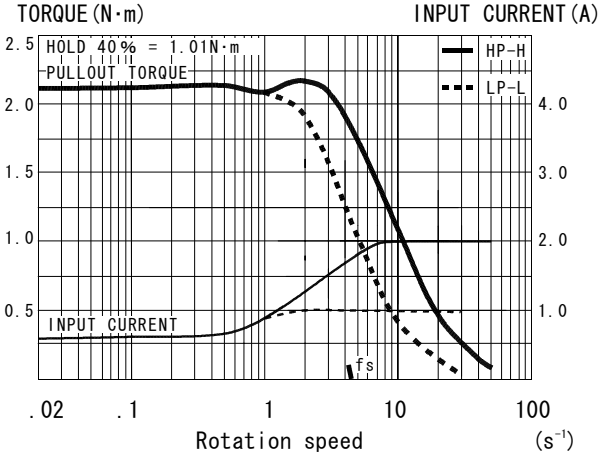
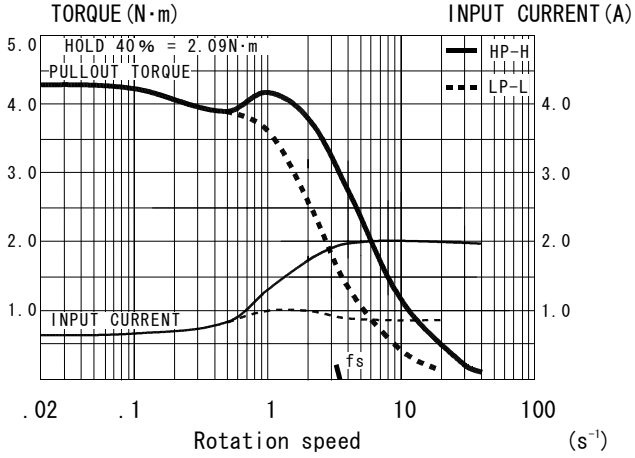


Fig.34

PK599-A(B)
1.4A/PHASE

MOTOR SEL = MH,1OL
DRIVE I.SEL = No.F
AC100V



１０. MAINTENANCE

⚠ WARNING

Potentioal electrical shock is apprehended.
Only specialized engineers are allowed to perform maintenance and checking.

⚠ WARNING

Potentioal electrical shock is apprehended.
Do not contact with a wet hand.

⚠ WARNING

Potentioal electrical shock is apprehended.
The marks, ⚠ and ⚠ on the front panel indicate terminals on which power voltage is applied.
Do not touch such terminals while inputting power and while POWER LED is on.

⚠ WARNING

Potentioal electrical shock,injury or fire is apprehended.
Do not replace fuse.
Do not disassemble CAD-5411S-570, repair or modify.

10-1.Maintenance and Inspection

(1)Cleaning Method

To operate CAD-5411S-570 in good conditions, clean them periodically as follows:

- Wipe them with dry soft cloth at the time of daily cleaning.
- When stains cannot be removed by wiping with dry cloth, moisten the cloth with thin neutral detergent and squeeze it hard for wiping.
- If rubber or vinyl products or tapes are stuck to CAD-5411S-570 for a long time, these products may be stained. Remove these stains, if any, at the time of cleaning.
- Do not use volatile solvents like benzine and thinner and chemical duster. Paint and label may be deteriorated sometimes.

(2)Inspection Method

To operate CAD-5411S-570 in good conditions, inspect them periodically.
In general, inspect them every 6 months or once a year.
When operating them in an extremely high temperature and high humid environment or in a very dusty environment, however, inspect them more frequently.

Inspection Item	Detail of Inspection	Criterion	Inspection Means
Environment Condition	Are the ambient temperature and the internal temperature of the system appropriate?	0～+40℃	Thermometer
	Are the ambient humidity and the internal humidity of the system appropriate?	10%～80%RH(non-condensing)	Hygrometer
	Haven't dusts gathered?	There should be no dust.	Visual check
Installation Condition	Is the product firmly fixed?	There should no loose parts. (6kg･cm)	Torque driver
	Are connectors inserted perfectly?	There should be no loose or disconnected parts.	Visual check
	Is there any cable going to be disconnected?	There should be no loose or disconnected parts.	Visual check
	Is there any connection cable being to be broken?	Appearance should be normal.	Visual check

(3)Replacing Method

When CAD-5411S-570 gets out of order, the whole system may be affected. So, repair it promptly.
To make repair works promptly, we recommend you to prepare spare equipment for replacement.

- Before replacement, stop the system and turn off the power supply to prevent electric shock and any accident.
- hen imperfect contact is supposed, wipe contacts with clean pure cotton cloth moistened with industrial alcohol.
- At the time of replacement, reset the internally stored data and switch setup to the state before the replacement.
- After the replacement, make sure that the new equipment is also in order.
- Return the removed defective equipment to us for repair together with a report detailing defects.

10-2.Storage and Disposal

(1) Storing Method

Store the CAD-5411S-570 in the following environment:

- Indoors (where the controller is not exposed to direct sunlight).
- A place where ambient temperature and humidity satisfy the specification.
- A place free from corrosive gas and inflammable gas
- A place free from dirt, dust, salt and iron powder.
- A place where the product body is protected from vibration and shock.
- A place not exposed to splashes of water, oil or chemical.
- A place where no one can get on the product and place any substance on it.

(2) Disposing Method

Dispose the product as an industrial waste.

10-3.Measures against Errors and Releasing Method

(1)Measures to be taken when an error occurred

Display on panel	Factor for error output	Troubleshooting for CAD-5411S-570	Error releasing method
E0	+ (CW) direction LIMIT signal is input.	・Stop PULSE output immediately.	・After return to $\overline{\text{RDY}}$, input $\overline{\text{START}}$ for releasing. ・Or, input $\overline{\text{RESET}}$ for returning.
E1	- (CCW) direction LIMIT signal is input.	・Stop PULSE output immediately.	・After return to $\overline{\text{RDY}}$, input $\overline{\text{START}}$ for releasing. ・Or, input $\overline{\text{RESET}}$ for returning.
E2	Stop PULSE output immediately.	・Stop PULSE output immediately.	・After return to $\overline{\text{RDY}}$, input $\overline{\text{START}}$ for releasing. ・Or, input $\overline{\text{RESET}}$ for returning.
E4	An undefined motion command is input.	・Wait until normal conditi ons are input.	・Input $\overline{\text{START}}$ of a defined motion command for releasing.
E5 *1	The panel key changes the Ext. Mode to Write Mode. (At the time, panel data can be set.)	・When the Ext. Mode is changed to Write Mode, output the error. ・After the Write Mode is returned to the Ext. Mode, hold in an error status even after return to $\overline{\text{RDY}}$.	・When the Ext. Mode is selected again with the Panel Modes key, the control ler returns to $\overline{\text{RDY}}$. ・Input $\overline{\text{START}}$, returned to $\overline{\text{RDY}}$ to relea se it from error.
E6	An error occurred in the data transmitting method from the high order.	・Wait until the normal setting method is input.	・Check the data setting method and the procedures and start the system again for releasing.
E7	A trouble occurred to the bus inside CAD-5411S-570.	・Wait until the trouble is removed.	・Check if the assembling was normal in cluding optional units.
E8 *2	The minimum-distance indexing became valid, and the SENSOR DRIVE started.	・Wait for a motion command other than SENSOR DRIVE.	・In case of SENSOR DRIVE in the rotary system, do not use the minimum-distan ce indexing.
E9	・The REST DRIVE started in the state exceeding +/-8,388,607 of the address control range. ・The REST DRIVE started other than after deceleration to stop.	・Wait for a motion command other than REST DRIVE.	・Input $\overline{\text{START}}$ other than REST DRIVE for releasing.
EA	A teaching caused the state exceeding +/-8,388,607 of ADDRESS control.	・Receive a teaching at +/-8,388,607 in the ADDRESS range.	・Release the system from error by designating a teaching ADDRESS in the +/-8,388,607 PULSE range.

*1: When WRITE DATA No. A9 is set to 0, the previous status is retained even when MODE is changed over, and the status of Err05H is not output. (The delivery status is set to 0.)

*2: WRITE DATA No.C0. decides if the minimum-distance indexing in the rotary system is used. When SENSOR DRIVE is used, the minimum-distance indexing cannot be used.

(2)Notice to High Order Sequencer

Status output signal						Header status		Meaning of output signal	Status code	Display on panel
$\overline{ST5}$	$\overline{ST4}$	$\overline{ST3}$	$\overline{ST2}$	$\overline{ST1}$	$\overline{ST0}$	$\overline{ERR}$	$\overline{RDY}$			
H	H	H	H	H	H	L	L	+ (CW) direction LIMIT stops entering. *1	Err00H	E0
H	H	H	H	H	L	L	L	-(CCW) direction LIMIT stops entering. *1	Err01H	E1
H	H	H	H	L	H	L	L	Stop by inputting STOP (immediate stop)	Err02H	E2
H	H	H	H	L	L	L	L	(Not used).	—	—
H	H	H	L	H	H	L	L	An undefined motion command is input.	Err04H	E4
H	H	H	L	H	L	L	H/L	Write Mode or S-Curve Mode is selected from Ext. Mode.	Err05H	E5
H	H	H	L	L	H	L	L	An error occurred in the procedures of setting DATA from EXTERNAL.	Err06H	E6
H	H	H	L	L	L	L	L	CAD-5411S-570 internal hard error occurred.	Err07H	E7
H	H	L	H	H	H	L	L	The minimum-distance indexing became valid, and the SENSOR DRIVE started.	Err08H	E8
H	H	L	H	H	L	L	L	An error occurred in REST DRIVE.	Err09H	E9
H	H	L	H	L	H	L	L	A position after teaching is outside the +/-8,388,607 PULSE range.	Err0AH	EA

*1 If an motion starts when both CW and CCWLM LIMITs are ON, CWLM is displayed and the status is output irrespective of direction.

10-4.Troubleshooting

Phenomenon	Check point
Nothing is displayed on the panel.	・Check if the power source is correctly connected. ・Check if the $\overline{\text{RESET}}$ signal was input and remains as it is. While the $\overline{\text{RESET}}$ signal is input, the display contents are not guaranteed.
The operation with panel is not possible.	・When the CAD-5411S-570 is operating in the External Modes, the operation with panel is not possible. Check in the RDY status. ・Check if OP.MASK, which prohibits operation from the panel, is not ON. ・Check if the operation mode is not set to OP2.
INDEX HSPD is not displayed.	・The OP0 mode (operation for operator) is selected. Press the OP0/OP1/OP2 selection hole, and select the OP1 or OP2 mode in which all data can be referred to.
Reference of S-Curve data cannot be set.	・Check if the drive type of WRITE DATA No. A0 is not set to 0 (trapezoidal drive). When the trapezoidal drive is set, S-Curve Data cannot be referred to and set from the panel and the External modes.
SCSPD1/SCSPD2 of S-Curve Data changes.	・Check if HSPD and LSPD are set by WRITE DATA and then S-Curve Parameters of SCSPD1/SCSPD2 are set. SCSPD1/SCSPD2 changes depending on setting of DRIVE TYPE, HSPD and LSPD.
The SPEED in DRIVE is different from the setting. Also, the driver does not operate as set.	・Check if the DRIVE TYPE is correctly designated. WRITE DATA No.A1 (L-TYPE=0, M-TYPE=1, H-TYPE=2) ・Check if the relations between the designated operation and the speed setting are correct. ・Review the setting of speed suitable for performances of the motor and the driver.
The motor does not drive even if $\overline{\text{START}}$ signal is input.	・Check if the External SEQ (SEQUENCER) Mode is selected. $\overline{\text{START}}$ signal is not accepted in the RS (RS232C) Mode and the Panel Modes except the SEQ Mode. ・Check if the $\overline{\text{RESET}}$, $\overline{\text{STOP}}$, CWLM and CCWLM signals are not input. (Pay attention to B contact of the CWLM and CCWLM signal logics.) ・Check if $\overline{\text{M0}}$～$\overline{\text{M8}}$ are not set to R.P.SET or input undefinition. ・Check if the travel of INDEX DRIVE (INCREMENTAL designation) is not set to 0. ・Check if start is arranged from the current ADDRESS (ABSOLUTE designation) to the same purpose ADDRESS. ・Check if RTN DRIVE is not started from the status already existing at the electrical zero.
The SENSOR DRIVE can not start.	・Check if WRITE DATA No. C0 is not valid for the minimum-distance indexing. While the minimum-distance indexing is valid, SENSOR DRIVE cannot be used.
The $\overline{\text{RDY}}$ signal is not turned on (LOW) after the end of DRIVE. Or, the return to $\overline{\text{RDY}}$ is slow.	・Check if the $\overline{\text{START}}$ signal was input and remains as it is.
Motion command from high order cannot start normally.	・Make sure that the $\overline{\text{RDY}}$ signal is LOW, and check if a handshake is conducted so that the $\overline{\text{START}}$ signal is output. ・Check if the $\overline{\text{START}}$ signal is turned off only after the $\overline{\text{RDY}}$ signal was confirmed to have become HIGH. ・Check the timing list of EXTERNAL motion in Chapter 6-4. once again. ・Check if the timing specification and the sequencer program are not incompatible. ・Check if cable is not disconnected or no command error occurs in communication through RS232C.
A stop from high order cannot be commanded normally.	・Check if the $\overline{\text{STOP}}$ signal is turned off only after the $\overline{\text{RDY}}$ signal was confirmed to have become LOW. ・Check Other Timing Specification in Chapter 8-12. once again.
No teaching is possible.	・Check if the External Mode was once set to the Teaching Mode (FDH). ・Check if teaching is not tried to be stored in places exceeding +/-8,388,607 PULSE of the coordinate control range.

Phenomenon	Check point
A position after teaching is different from actual positioning.	・Check if any PULSE other than 0 is not set to the TEACHING OFFSET of WRITE DATA No. F5. If any PULSE other than 0 is set, the coordinates are corrected (by relative move) by the OFFSET from the coordinate after teaching.
The machine home can not be detected correctly.	・Check if ORG TYPE of WRITE DATA No. b0 satisfies the specifications such as necessary quantity, layout, detection level (+24V), etc. of the ORG sensor. In case of ORG-4, 5 and 10, the necessary distance between NORG and ORG is expressed as N ≧ 0.005xCSPD in equivalent to pulse (N) as well as in use of disk slit. ・Check if mechanical hunting does not occur. Try to set several pulses so as to escape hunting width with WRITE DATA No.b4. Or, try to insert a delay time with MARGIN TIME of WRITE DATA No.b5.
POWER LED does not come on	・Connection of power supply. Wiring error with power supply. ・Value of power voltage. Power voltage failure. ・CAD-5411S-570 failure.
The motor is not excited. (It can be easily rotated by hand.)	・Connection of the motor to the CAD-5411S-570. Wiring error with the motor and the CAD-5411S-570. ・ON/OFF status of the $\overline{\text{M.F}}$ signal. The $\overline{\text{M.F}}$ signal is input. ・Value of the HOLD CURRENT ADJUSTMENT trimmer. Hold current is set to zero. ・CAD-5411S-570 failure.
The motor does not rotate. The motor behaves abnormally. The motor steps out.	・The same check items as those under item two above-mentioned phenomena. ・Setting of the MOTOR SELECT switch. Wrong setting for the motor selection. ・Connection of the pulse signal. Wiring error with the pulse signal line. ・Voltage and wave form of the pulse signal. Pulse signal of wrong specifications. ・Value of the DRIVE CURRENT SELECT switch. Drive current is too low. ・Value of the STEP ANGLE SELECT switch. Wrong setting for the STEP ANGLE. ・ON/OFF status of the $\overline{\text{C.S}}$ signal. The $\overline{\text{C.S}}$ signal is input. ・CAD-5411S-570 failure. ・Motor failure.
The motor steps out during acceleration.	・Start-up pulse speed. Start-up pulse signal speed is too high. ・Acceleration time. Acceleration time is too short. ・Setting of the POWER SELECT switch. The setting for the POWER SELECT is too low.
The motor generates excessive heat.	・Value of the DRIVE CURRENT SELECT switch. DRIVE current is higher than the setting for the applicable motor. ・Value of the HOLD CURRENT ADJUSTMENT trimmer. The setting for HOLD current is too high.
$\overline{\text{O.H.A}}$ signal is output.	・Ambient temperature around the driver. Ambient temperature is too high(40℃ or higher).

■Short-circuiting of the motor output terminal may cause the driver to fail.
Short-circuiting between:
・The motor output terminal and the earth terminal(PE).
・The motor output terminal and the power line.
・The motor output terminal and the motor output terminal.

R3

Technical Service

TEL.(042)664-5382 FAX.(042)666-5664
E-mail s-support@melec-inc.com

Sales and Service

TEL.(042)664-5384 FAX.(042)666-2031
URL:http://www.melec-inc.com

Melec Inc. Control equipment marketing department
516-10,Higashiasakawa-cho,Hachioji-shi,Tokyo 193-0834,Japan

This Operating Manual is subject to change without prior notice
for the purpose of product improvement.

C□□□□